CALIFORNIA INSTRUMENTS

CIMRON

MODEL DMC-45

DIGITAL MULTIMETER/COUNTER

CALIFORNIA INSTRUMENTS
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ROCKFORD INSTRUMENT LAB
1718 Broadway
Rockford, IL 61104

INSTRUCTION MANUAL

CIMRON®

MODEL DMC™-45 DIGITAL MULTIMETER /COUNTER

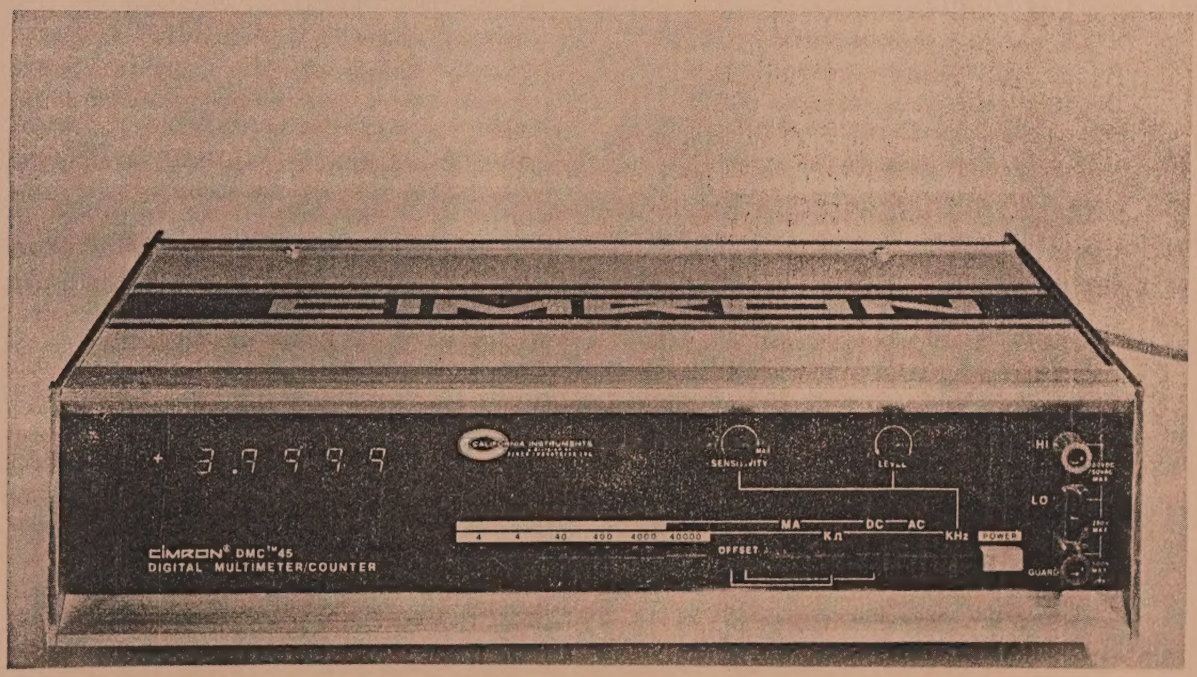


FIGURE 1-1

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE
1-1	MODEL DMC 45 DIGITAL MULTIMETER/COUNTER	Frontispiece
3-1	FUNCTIONAL BLOCK DIAGRAM	3-1
3-2	TIMING DIAGRAM	3-3
3-3	PRINT-OUT PIN ALLOCATION	3-11
4-1	LOCATION OF ADJUSTMENTS	4-1

LIST OF TABLES

TABLE	TITLE	PAGE
4-1	CALIBRATION PROCEDURE	4-3

LIST OF DRAWINGS

ASSEMBLY REFERENCE DESIGNATOR	DRAWING NUMBER	TITLE
	8545-900	OUTLINE DRAWING
	8545-070	DIGITAL/ANALOG SCHEMATIC
	8545-071	BATTERY CHARGER SCHEMATIC
	8545-400	UNIT ASSEMBLY
A1	8545-700	DIGITAL/ANALOG BOARD SCHEMATIC
A2	8545-701	DISPLAY ASSEMBLY
A3	8545-702	BATTERY CHARGER BOARD ASSEMBLY

TABLE OF CONTENTS

		PAGE
GENERAL DESCRIPTION		
1.1	INTRODUCTION	1-1
1.2	DESCRIPTION	1-1
1.3	EQUIPMENT SUPPLIED	1-1
1.4	ACCESSORY EQUIPMENT	1-1
INSTALLATION AND OPERATION		
2.1	UNPACKING	2-1
2.2	POWER REQUIREMENT	2-1
2.3	OPERATING CONTROLS	2-1
2.4	ACCEPTANCE TEST PROCEDURE	2-2
2.5	INSTALLATION	2-3
THEORY OF OPERATION		
3.1	GENERAL	3-2
3.2	DETAILED CIRCUIT DESCRIPTION	3-4
3.2.1	ANALOG TO DIGITAL CONVERTER, ANALOG SECTION	3-4
3.2.2	ANALOG TO DIGITAL CONVERTER, DIGITAL SECTION	3-6
3.2.3	COUNTER OPERATION	3-8
3.2.4	POWER SUPPLY	3-9
3.2.5	BATTERY PACK OPERATION	3-9
3.2.6	PRINT OPERATION	3-10
CALIBRATION AND TEST PROCEDURE		
4.1	TEST EQUIPMENT REQUIRED	4-2
4.2	CALIBRATION PROCEDURE	4-2
MAINTENANCE AND TROUBLESHOOTING		
5.1	GENERAL MAINTENANCE	5-1
5.2	TROUBLESHOOTING	5-1
CIRCUIT DIAGRAM		
6.1	GENERAL	6-1
6.2	REFERENCE DESIGNATIONS	6-1

REPLACEMENT PARTS PAGE

7.1 GENERAL 7-1

7.2 ORDERING INFORMATION 7-1

PARTS LIST

APPENDIX A

CODE LIST OF MANUFACTURERS

SPECIFICATIONS

ALL SPECIFICATIONS ARE TESTED IN ACCORDANCE WITH CALIFORNIA INSTRUMENTS TEST PROCEDURE

GENERAL

INPUT	Floating and guarded with the guard brought out to front panel.
DISPLAY	LED (Light Emitting Diodes) 0.33" high.
MAXIMUM INPUTS	
DC	1200 volts
AC	750 volts or a volt/Hz product not to exceed 10^7
RESISTANCE	40 megohm
FREQUENCY	20 MHz
CURRENT	2 amperes. Current ranges fused to full scale input values.
COMMON MODE VOLTAGE	500V
RESOLUTION, ALL FUNCTIONS	1 part in 40,000
OVERLOAD INDICATION	Blinking display.
CONVERSION RATE	2 per second except for 400 Hz, 4 KHz, 40 KHz frequency ranges where it is .87 per second.
RANGE SELECTION	Manual by pushbuttons.
FUNCTION SELECTION	5 pushbutton array.
KHz LEVEL	Rotary knob sets point of trigger on input waveform.
SENSITIVITY	Rotary knob maximum sensitivity fully clockwise.
INPUT POWER	105 to 125 or 210 to 240 volts at 48 to 420 Hz; 15 watts maximum.
BATTERY OPERATION	(Option 1) Up to 8 hours; (Option 1A) Up to 16 hours; 14 hours required for full recharge.
OPERATING TEMPERATURE	0° + 55°C.
STORAGE TEMPERATURE	-20° + 85°C.
HUMIDITY	0 to 80% at 25°C, non-condensing.
ALTITUDE	0 to 10,000 feet operating; 0 to 50,000 feet non-operating.

SIZE	3.5" height x 15" wide x 12.25" deep.
NET WEIGHT	11 pounds 14.5 pounds with option 01 18 pounds with option 01A
DATA OUTPUTS IN PARALLEL FORMAT (Option 02)	1-2-4-8 BCD. 0 volts = "1" state, +5 volts = "0" state. Includes 4 full digits plus overload, overrange, polarity, range, data ready and busy lines.

DC VOLTAGE MEASUREMENT

RANGES	±.4, 4, 40, 400, 1200 volts.
ACCURACY	
for 90 DAYS at 25°C ±5°C	
4, 40, 400, 1200 volt ranges	±(0.01 of reading +0.0025% of full scale)
.4 volt range	±(0.02% of reading +0.01% of full scale)
TEMPERATURE COEFFICIENT	
4, 40, 400, 1200 volt ranges	±(0.002% of reading +0.00025% of full scale) per °C
.4 volt range	±(0.003% of reading +0.00025% of full scale) per °C
INPUT IMPEDANCE	
.4 and 4 volt ranges	1000 Megohm
40, 400, 1200 volt ranges	10 Megohm
NORMAL MODE REJECTION	50dB at 60 Hz.
COMMON MODE REJECTION	120dB at 60 Hz when operating from AC line. Infinite with battery operation and AC line cord removed.

DC CURRENT MEASUREMENT

RANGES	±.4, 4, 40, 400, 2000 milliamperes
ACCURACY	
for 90 DAYS at 25°C ±5°C	±(0.2% of reading +0.01% of full scale)
TEMPERATURE COEFFICIENT	±(0.005% of reading +0.0005% of full scale) per °C
NORMAL MODE REJECTION	50dB at 60 Hz.
SHUNT VOLTAGE-MAXIMUM	.4 volts full scale, plus fuse drop.
COMMON MODE REJECTION	120dB at 60 Hz when operating from AC line. Infinate with battery operation and AC line cord removed.

AC VOLTAGE MEASUREMENT

RANGES	.4, 4, 40, 400, 750 volts (.4 and 750 volt ranges limited to 20 KHz).
ACCURACY	
for 90 DAYS at 25°C ±5°C 4, 40, 400, 750 volt ranges	±(0.1% of reading +0.0075% of full scale) from 50 Hz to 10 KHz. ±(0.5% of reading +0.025% of full scale) from 30 Hz to 50 Hz and from 10 KHz to 50 KHz. ±(1.0% of full scale) from 50 KHz to 100 KHz.
.4 volt range	±(0.2% of reading +0.075% of full scale) from 50 Hz to 20 KHz.
TEMPERATURE COEFFICIENT	
4, 40, 400, 750 volt ranges	±(0.01% of reading +0.0005% of full scale) per °C from 50 Hz to 20 KHz. ±(0.025% of reading +0.0025% of full scale) per °C from 30 Hz to 50 Hz and from 20 KHz to 100 KHz.
INPUT IMPEDANCE	1 Megohm in parallel with 100pF maximum.
COMMON MODE REJECTION	120dB at DC to 100dB at 60 Hz when operating from AC line. Infinate with battery operation and AC line cord removed.

AC CURRENT MEASUREMENT

RANGES	.4, 4, 40, 400, 2000 milliamperes.
ACCURACY	
for 90 DAYS at 25°C ±5°C	±(0.25% of reading +0.125% of full scale) from 50 Hz to 10 KHz on .4, 4 and 40 milliampere ranges; from 50 Hz to 5 KHz on 400 milliampere range; from 50 Hz to 2 KHz on 2000 milliampere range.
TEMPERATURE COEFFICIENT	
.4, 4, 40, 400 milliampere ranges	±(0.02% of reading +0.0005% of full scale) per °C.
2 ampere range	±(0.03% of reading +0.0005% of full scale) per °C.
COMMON MODE REJECTION	120dB at DC to 100dB at 60 Hz when operating from AC line. Infinate with battery operation and AC line cord removed.

RESISTANCE MEASUREMENT

RANGES	.4KΩ, 4KΩ, 40KΩ, 400KΩ, 4MΩ, 40MΩ.
TEST CURRENT	1ma, 1ma, .1ma, 10μa, 1μa, .1μa.
ACCURACY	
for 90 DAYS at 25°C ±5°C	
.4KΩ range	±(0.03% of reading +0.01% of full scale)
4KΩ, 40KΩ, 400KΩ ranges	±(0.02% of reading +0.0025% of full scale)
4MΩ range	±(0.05% of reading +0.0025% of full scale)
40MΩ range	±(0.25% of reading +0.005% of full scale)
TEMPERATURE COEFFICIENT	
.4KΩ, 4KΩ, 40KΩ, 400KΩ ranges	±(0.002% of reading +0.0005% of full scale) per °C.
4MΩ range	±(0.005% of reading +0.0005% of full scale) per °C.
40MΩ range	±(0.02% of reading +0.00125% of full scale) per °C.
INPUT CONFIGURATION	2 wire.
OPEN CIRCUIT VOLTAGE	6 volts maximum.
INPUT PROTECTION	325 volts DC or peak AC

FREQUENCY MEASUREMENT

RANGES	400 Hz, 4 KHz, 40 KHz, 400 KHz, 4 MHz, 20 MHz.
ACCURACY	
for 90 DAYS at 25°C ±5°C	
.4 KHz and 4 KHz ranges	±(0.02% of reading +0.0075% of full scale)
40 KHz and 400 KHz ranges	±(0.01% of reading +0.0025% of full scale)
4 MHz and 20 MHz ranges	±(0.025% of reading +0.005% of full scale)
TEMPERATURE COEFFICIENT	±(0.00025% of full scale) per °C.
INPUT IMPEDANCE	.5 Megohm in parallel with 100pf.
SENSITIVITY	0.15 volt rms from 10 Hz to 1 MHz; 0.25 volts rms from 1 MHz to 10 MHz; 0.5 volts rms from 10 MHz to 20 MHz.
SETTLING TIME	
400 Hz, 4 KHz ranges	5 seconds maximum for step input (typically 1 second)
40 KHz range	2 seconds maximum for step input (typically 1 second)
400 KHz, 4 MHz, 20 MHz range	1 second maximum for step input (typically .6 seconds)

GENERAL DESCRIPTION

1.1 INTRODUCTION

This instruction manual contains information on the installation, operation, calibration and maintenance of the CIMRON® DMC 45 Digital Multimeter/Counter. A photograph of the instrument is shown in Figure 1-1.

1.2 DESCRIPTION

The CIMRON® DMC 45 Digital Multimeter/Counter measures DC voltage, AC voltage, current resistance and frequency.

The ranges and functions are selected by push buttons located on the front panel.

The CIMRON® DMC 45 Digital Multimeter/Counter operates from 115 volts AC or 230 volts AC from 50 to 400 Hz, and consumes less than 7 watts.

1.3 EQUIPMENT SUPPLIED

The unit is shipped with the following:

1 - CIMRON® DMC 45 Instruction Manual

1.4 ACCESSORY EQUIPMENT

The following accessories are available for use with the DMC 45 Digital Multimeter/Counter.

1.4.1 Option 01 Battery Pack. This option includes charger and battery for up to 8 hours off line operation.

1.4.2 Option 01A Battery Pack. This option includes charger and batteries for up to 16 hours off line operation.

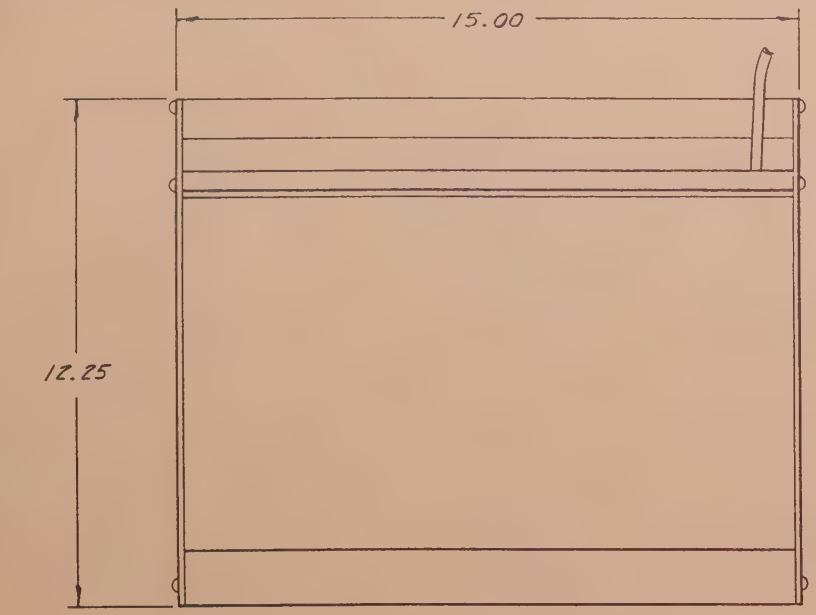
1.4.3 Option 02 Data Outputs. This option permits coupling of BCD output data to a recording device.

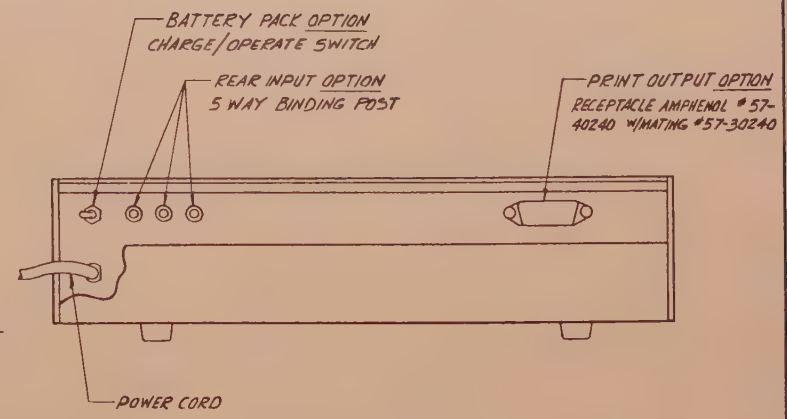
1.4.4 Option 03 Input Signal Cable. This cable mates with the front panel binding posts on the DMC 45 Digital Multimeter/Counter. The other end is terminated with alligator clips.

1.4.5 Option 04 Rack Mount. The DMC 45 may be purchased with rack mount brackets for mounting in a standard 19 inch cabinet.

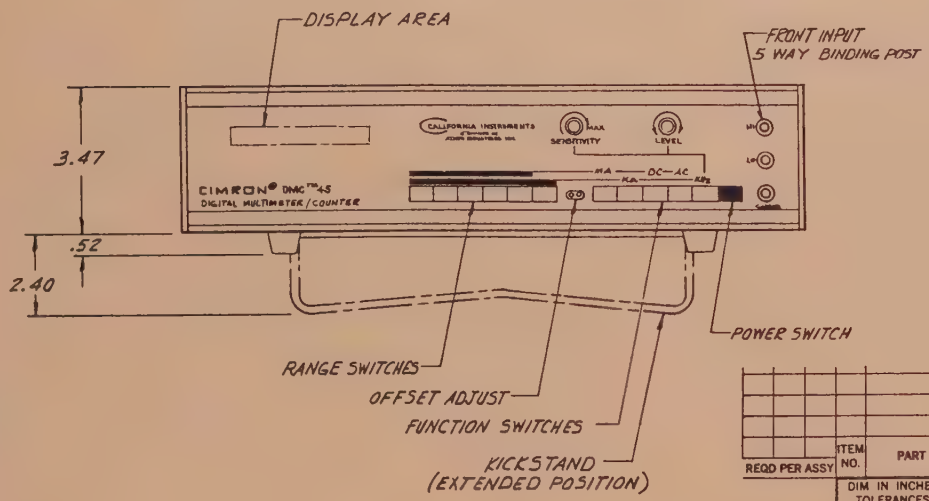
1.4.6 Option 05 Rear Input. This enables parallel input signals to be coupled in from rear panel.

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD





REAR VIEW



REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

DIM IN INCHES
TOLERANCES
.XXX = .010
.XX = .03
X° = 30'

BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES ✓

DWG SIZE C

TITLE
OUTLINE DRAWING
DIGITAL MULTIMETER/COUNTER

MODEL DMC 45

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DESIGN		CHF ENGR	
DRFTSMN	8/6/73		

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CONTRACT NO.

CODE IDENT 16067

DWG NO. C8545-900 REV B

SCALE 1/2 SHEET 1 OF 1

CALICO F-386

NOTES: (UNLESS OTHERWISE SPECIFIED)

C8545-900 B

1-2

WARNING

HIGH VOLTAGE 115/230 VRMS

2.1 UNPACKING

This instrument is shipped in a protective container. Do not destroy the packing material until the unit has been inspected for possible damage in shipment.

2.2 POWER REQUIREMENTS

This unit operates from 115 VAC or 230 VAC (as set by internal jumpers) at 48 to 420 Hz. The power consumption is 15 watts or less without battery pack installed.

2.3 OPERATING CONTROLS

2.3.1 FRONT PANEL CONTROLS

2.3.1.1 RANGE SWITCH

The range switch is a 6 station, interlocked pushbutton switch located in the middle of the front panel. The 6 ranges are .4, 4, 40, 400, 4000 and 40,000.

2.3.1.2 FUNCTION SWITCH

The function switch is a 5 station pushbutton switch located on the right side of the instrument. The functions are MA, KΩ, DC, AC and KHz. The KΩ, DC, AC and KHz switches are interlocked and the MA switch is a push on - push off. The MA switch must be in the off (out) position except when measuring current.

2.3.1.3 POWER SWITCH

The power switch is located on the right side of the function switch and is a push on - push off type of switch.

2.3.1.4 KHz LEVEL CONTROL

With the KHz sensitivity control set fully clockwise, rotate the level control fully clockwise. Then slowly rotate the level control counter-clockwise until a phase lock is indicated in the lower two ranges or steady reading in the upper four ranges. Phase lock is indicated on an unblinking + Pol sign.

2.3.1.5 KHz SENSITIVITY CONTROL

After a phase lock or steady reading, as applicable, is acquired, turn the sensitivity fully counter-clockwise. Then slowly rotate clockwise until the reading again stabilizes. This procedure minimizes the possibility of locking on a harmonic.

2.3.1.6 OFFSET ADJUSTMENTS

The offset controls are recessed between the range and function switches. The right hand offset is set in .4 volt range DC for zero. This compensates for thermals and offsets in front of the auto-zeroed circuits. The left hand offset control is the KΩ offset and compensates for resistance in input cable.

2.3.2 REAR PANEL CONTROLS

Battery control switch. This switch controls the battery charger. It should be in the up position when operating from the internal battery and down at all other times. If the switch is left up when operating from the AC line, no damage will occur, but the battery will not charge properly and if the battery is already charged, partial discharge will occur. For best battery charging efficiency the switch should be in the down position and the front panel power switch turned off.

2.4 ACCEPTANCE TEST PROCEDURE

Inspect the unit for any possible shipping damage immediately upon receipt. If any damage is evident, notify the carrier, DO NOT return the instrument to the factory without prior approval. If the unit appears to be in good condition, perform the following:

NOTE

The DMC 45 is normally shipped from the factory ready to operate from 115 VAC. To convert to 230 volt operation, remove the covers and bottom shield, and lift the red and orange primary wires at the rear right side of the transformer and re-solder them into the two empty holed approximately .3 inches forward of the holes the wires were removed from. Change line fuse A1F1 to 1/8 ampere slow-blow. Clean area and replace covers and shield.

a) Turn the unit on and allow to warm-up for 15 minutes.

b) Short the input leads, select the DC function and the 4 range. Check that the display reads all zeros. If the display does not read all zeros, select the .4 range and adjust the DC offset for zero. Return to the 4 range and check for all zeros.

c) Using a COHU Model 351 or equivalent, apply +1.0000 volt to the input jacks. The display should indicate +1.0000 ±2 digits.

d) Select the AC function and the 4 range. Using a Hewlett Packard 745 AC calibrator apply 1 VRMS at 1 KHz to input jacks. The display should indicate 1.0000 ±13 digits. Leave input connected.

e) Select the KHz function and if required adjust sensitivity and level controls. Display should read frequency as set on AC calibrator. Approximately 1 KHz.

f) Select the KΩ function and the 4 range. Connect the input leads to a precision 1 KΩ ±.005% resistor. The display should indicate 1.0000 ±4 digits.

If further evaluation is required see section 4.3 of this manual.

2.5 INSTALLATION

The DMC 45 may be bench mounted, rack mounted or left portable for battery operation. When mounted, the unit should be installed in such a manner that free air flow around case is not obstructed. Care should be taken not to install unit in areas where other equipment may produce excessive heat.

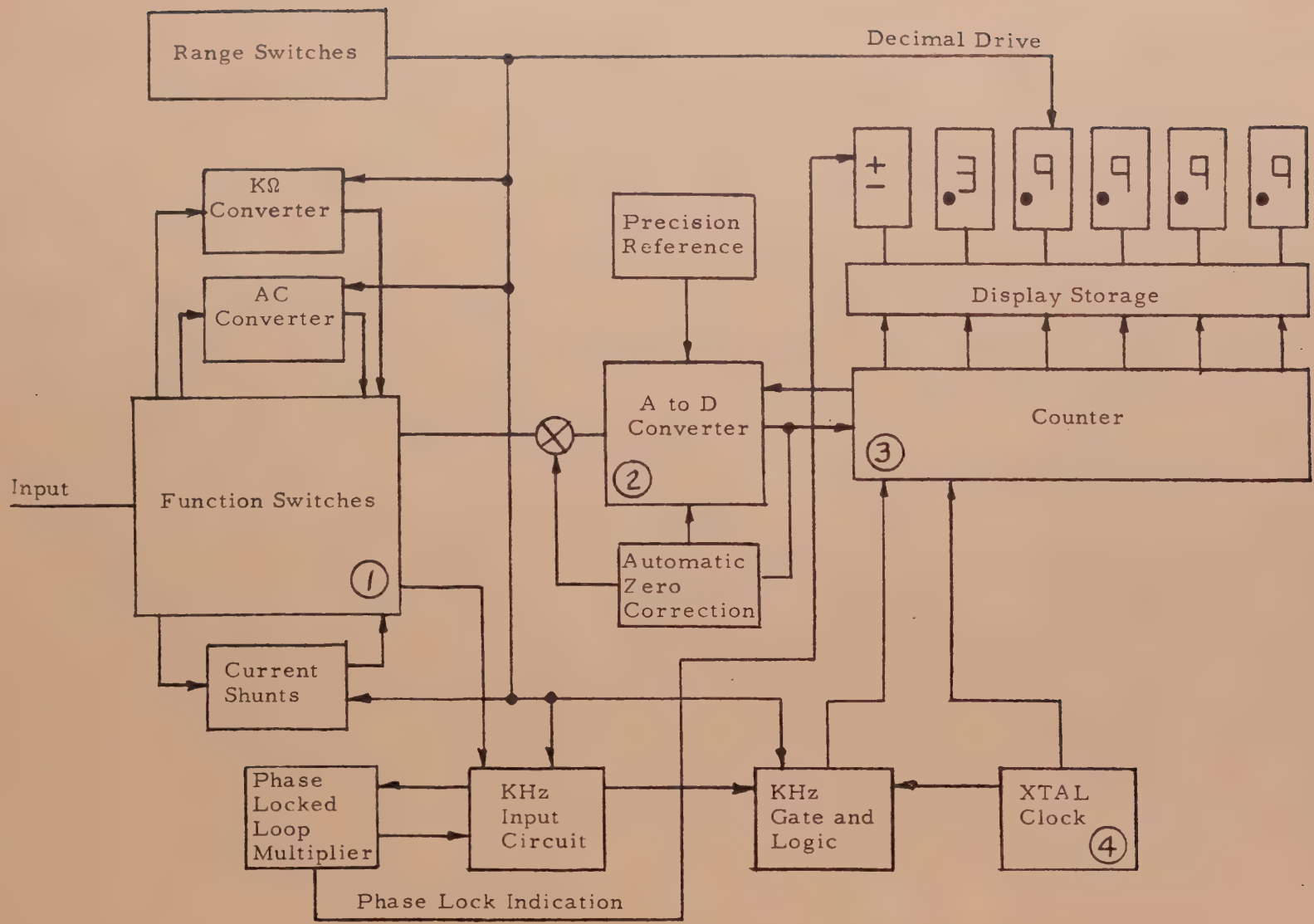


Figure 3-1

Functional Block Diagram for Cimron® DMC 45 Digital Multimeter/Counter

3.1 GENERAL

The CIMRON® DMC 45 Digital Multimeter/Counter is a precision voltmeter that measures DC voltage. The measurement of AC volts, and ohms is accomplished by first converting these inputs to a DC voltage then measuring the DC voltage. The measurement of current is accomplished by measuring the voltage drop (AC or DC) across a precision shunt and then making the A to D conversion. Frequency is measured by gating the unknown frequency into the decade counters for a fixed period of time.

In the DC function, the input is routed to the Deca state analog to digital converter. In the 10 step A to D, the counter is continously counting the 200 KHz clock frequency. Each 10, 000 counts the counter control steps states thus there is no requirement for a start generator. During states 8 and 9 (see timing diagram Figure 3-2) the unknown is being integrated. During states 0, 1, 2 and 3 the precision reference is being integrated,which causes the integrator to drive back to zero,at which time a zero detect takes place. At zero detect, the total in the counter is strobed into the display storage and the counter is allowed to continue running. If at 40, 000 counts, zero detect has not taken place, the 4 state of the control counter forces the strobe. At strobe time the instrument goes into the auto-zero mode which corrects any initial offsets and/or temperature drifts in the A to D converter. The zero mode will continue until the control counter again sets the 8 state and the cycle is repeated.

When operating in the KHz function, the input is routed to the KHz input circuit which translates the signal to TTL levels. This signal is then processed in a different manner than that used in most frequency counters. During the 0, 1, 2 and 3 states of the control counter a precision gate is generated. When the control counter sets the 0 state, the internal 200 KHz clock is disconnected from the decade counters and the output of the KHz input circuit is connected, which allows the decade counters to count the input frequency during gate time. At the end of the gate time the total count is strobed into the display storage and the 200 KHz clock is re-connected. The 200 KHz clock will re-cycle the control counter to the 0 state at which time the cycle restarts.

When the 400 Hz or 4 KHz range is selected, the output of the KHz input circuit is routed through a phase-locked frequency multiplier which multiplies by 10 or 100, as selected. This is then counted on the 40 KHz range.

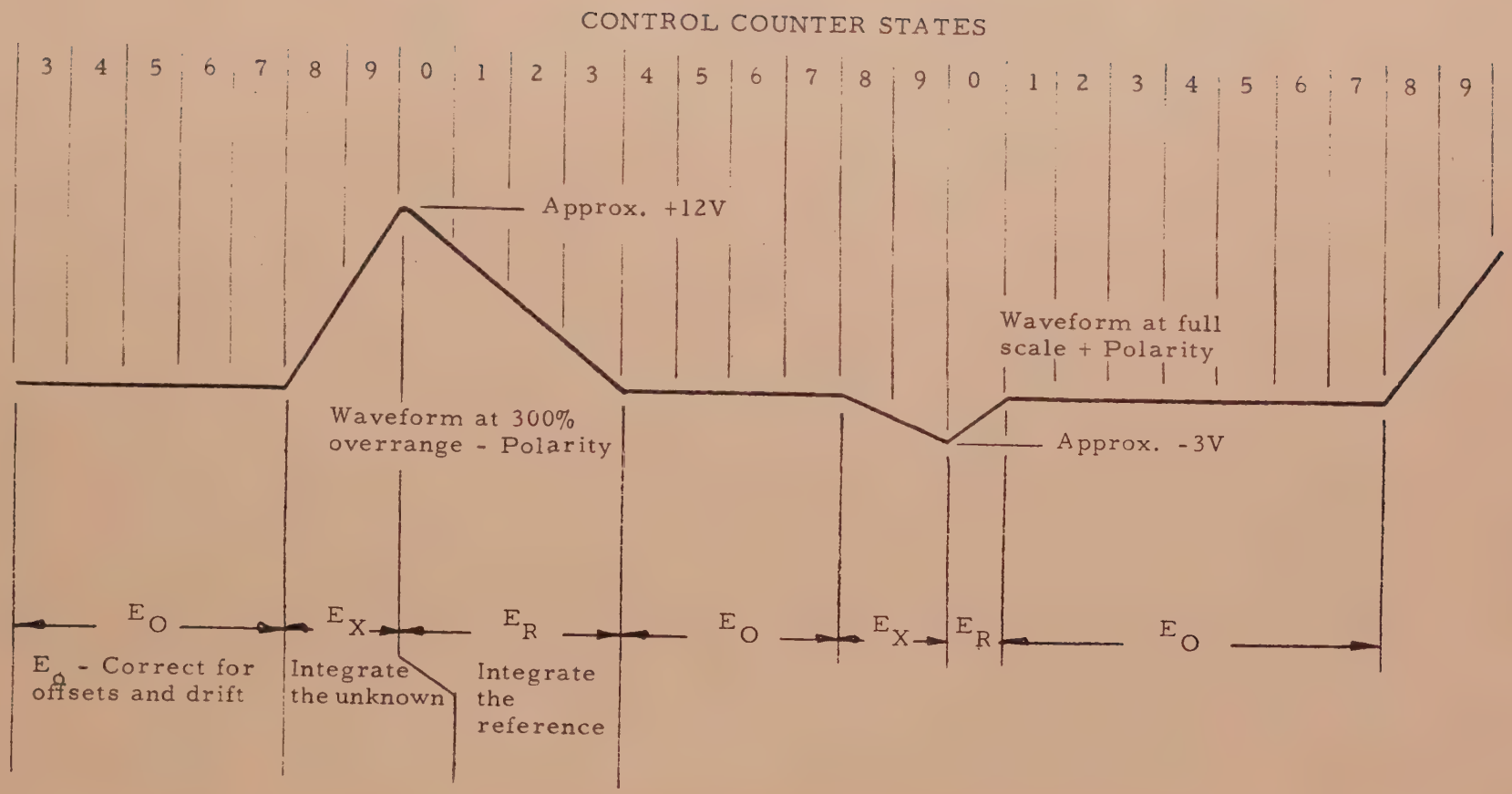


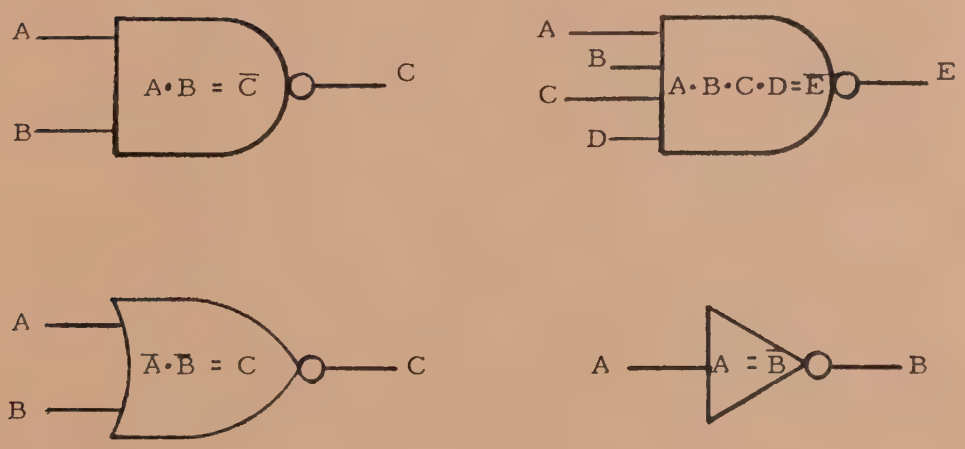
Figure 3-2
Timing Diagram for Cimron® DMC 45 Digital Multimeter/Counter
Integration Waveform

When the phase-locked-loop is locked, pins 1 and 2 of A1IC35 will alternately be high thus A1IC30A pin 1 will be low. This low in conjunction with A1IC13 pin 11 being low in 400 Hz or 4 KHz range will cause A1IC5A pin 3 to go low turning on the + polarity sign to indicate phase lock. Zero frequency input will generally indicate a phase lock also.

3.2 DETAILED CIRCUIT DESCRIPTION

The schematic diagram for the CIMRON® DMC 45 is drawing number E8545-070, which is divided into two sheets. Sheet 1 of 2 contains the logic, display and power supplies and sheet 2 contains the analog circuitry.

The logic utilized in this instrument is of the TTL type and is basically the NAND and NOR type. A logic "0" state is defined to be between 0 and + .4V. A logic "1" state is defined to be between + 2.4 and + 5 VDC. The truth table for this logic is as follows:



3.2.1 ANALOG TO DIGITAL CONVERTER, ANALOG SECTION

During the E_O states, (refer to timing diagram Figure 3-2) the A to D is being re-zeroed to compensate for drift. At this time pin 3 of level shifter A1IC41 (see schematic 8545-070, sheet 2) is plus so pin 6 is plus and FET A1Q15 is on shorting the input of FET amplifier A1IC42 to common through A1R95. The output of A1IC42 is applied through A1R148 to the summing function of integrating amplifier A1IC43. The output of A1IC43 is applied to comparator amplifier A1IC45. During E_O time level shifter A1Q23 has turned on FET A1Q21. The output of A1IC45 is divided by A1R133, A1R134 and applied through A1Q21 to the gate of FET follower A1Q19.

The output of A1Q19 is fed through A1R112 back to the junction of the integrator A1IC43. It may be seen that the above described circuitry will seek on equilibrium and that the result will correct the integrator summing junction to zero. This zero will include all the offsets and drifts of A1IC42, A1IC43, A1IC45 and associated circuitry. At the end of E_O time A1Q21 will turn off and A1C49 will store the zero during conversion time.

At the end of E_O time, level shifter A1IC41 will turn off A1Q15 and level shifter A1IC40 will turn on A1Q14 which connect A1IC42 to the input signal. If the input signal were -1 V the output of A1IC42 slew to -1 V, which, during the 100 MS E_X time would cause the integrator output to ramp to approximately + 3.0 V. At the end of E_X time A1Q14 would turn off and A1Q15 would turn on dropping the output of A1IC42 to zero. At the same time level shifter A1Q11 would turn on FET A1Q17 applying the + 10 reference through A1R108 and A1R109 to the integrator summing junction. This + 10 V is 10 times the input voltage but A1R117 is 5 times the resistance of A1R148 so the integrator will ramp back to zero at twice the rate of the up slope. At the same time that A1Q11 turned on A1Q17 it also turned on A1Q16 which offset pin 2 of the comparator by the analog equivalent of 100 digits. It may be seen that the zero detect (change of state at the output of A1Q22) will now take place slightly after the integrator output passes through zero. This is compensated in the digital circuitry and is done to linearize the scale.

When operating in the 400 MV range the top of A1R102 and the bottom of A1R106 are connected to common. Now A1IC42 has a gain of 10 so with 100 MV input the output will swing to 1 V and be digitized as 1 V.

Transistors A1Q12 and A1Q13 are FETs used as very low leakage protection diodes. A1R91, front panel DC offset, is used to correct for thermals and offsets in front of the auto-zero circuitry.

Diode A1CR31 is the precision, temperature corrected, reference diode and A1IC44 is the positive reference amplifier. A1IC47 is the negative reference amplifier.

FET amplifier A1IC46 is the ohms converter and is operated as an inverting operational amplifier with the unknown resistor as the feedback resistor. By tracing through the switches, it may be found that in the 4 K range the + 10 reference is applied through A1R84 and A1R87 to the summing junction pin 2 of A1IC46. This will allow 1 ma to flow into the summing junction so when R_X (the unknown) is 2K, 1 ma of the opposite polarity will flow into the summing junction and equilibrium will occur. To make 1 ma flow through the 2 K R_X the output of A1IC46 must be at -2 V which is applied to the A to D and read out as 2.0000 KΩ.

If a negative voltage is accidently applied to the ohms converter, A1CR44 will turn off thus protecting the output stage of A1IC46. If a positive voltage is applied to the ohms converter the action of A1CR42, A1CR43, A1R136 and A1Q24 will limit the current to approximately 3 ma and this will not harm the output circuit of A1IC46.

AC conversion is accomplished by A1IC38 and A1IC39 and associated circuitry. The AC input is routed through the input switching to DC blocking capacitor A1C24. It passes through A1C24 and A1R42 to the AC summing junction. FET follower A1Q9 buffers the input to A1IC38 which with A1CR25 and A1CR26 is the precision rectifier. The feedback path in the 4 V range is through A1R49 or A1R52, dependent upon the instataneous polarity, through A1R56, and A1R63 to common. The arm of A1R56 connects the feedback to A1R48 and A1R45 back to the input summing junction. In the 40, 400, and 4 KV range other networks are switched in parallel with A1R44 and A1R45 to scale the ranges. The various capacitors across the precision resistors are for high frequency compensation.

Integrated circuit A1IC39 is a differential amplifier operating at a gain of slightly less than 1. A1C35, A1C36, A1C37 and A1C40 filter the full wave ripple of A1IC39 and this is fed to the A to D converter. A1R75 is the AC zero adjust.

When measuring current, a precision resistor is switched in shunt with the input leads and the voltage drop is sensed at the resistor to minimize errors due to switch resistances. The voltage drop is fed to the A to D when operating in DC current and through the AC converter when operating in AC current.

3.2.2 ANALOG TO DIGITAL CONVERTER, DIGITAL SECTION

During all A to D conversions (all functions except counter) the switched +5 V is zero. This shuts down all counter functions.

The 1 MHz oscillator at B-1 (see schematic 8545-070, sheet 1) is crystal controlled and is variable over a narrow range by A1C20. This is set at 1 MHz at the factory and should need no further adjustment.

The 1 MHz clock is counted down to 200 KHz by A1IC33 for use in the A to D conversion. The 200 KHz is coupled through A1IC21D and A1IC17B to pin 14 of A1IC12. A1IC12 is the units decade counter. The 20 KHz output of A1IC12 is further counted down by A1IC11, A1IC10, and A1IC9 to 20 Hz at pin 11 of A1IC9. The 20 Hz at pin 14 of state counter A1IC8 is counted and decoded to generate the 10 counter control states shown on the timing diagram.

When pin 11 of A1IC8 (the 8 output) goes high it is inverted by A1IC14 pins 5 to 6 and becomes the $\overline{E_X}$ signal which starts the conversion cycle. $\overline{E_X}$ sets A1IC7B which causes Q to go high and $\overline{Q}$ to go low, this turns on the E_X level shifters in the analog section and ends the $\overline{E_O}$ phase. The analog section is now in the up slope phase. 10,000 counts after $\overline{E_X}$ started A1IC8 will step to a 9, but, as the 8 is still set the upslope will continue another 10,000 counts. As each 10,000 counts at 200 KHz requires 50 MS the total $\overline{E_X}$ time will be 100 MS or 6 line cycles at 60 Hz.

At the end of the 20,000 count $\overline{E_X}$ the A1IC8 outputs will all drop to lows which in turn will cause pin 5 of A1IC19 to go high. Pin 4 of A1IC19 was set high by setting A1IC7B so the output will drop to a low generating the $\overline{E_R}$ condition.

Several things happen at the time that $\overline{E_R}$ goes low. The ZERO DET line (which is the output of the analog comparator) is applied to pin 2 of clocked flip-flop A1IC7A. The clock for A1IC7A was connected to $\overline{E_X}$ so when $\overline{E_X}$ went high it clocked into storage the state of the ZERO DET line. This set the conditions of A1IC7A and $\overline{Q}$ which will drive the polarity sign in DC and set the levels at the inputs to A1IC13 A and B. Pins 2 and 6 of A1IC13 were driven low at the start of $\overline{E_R}$, so depending on polarity of the input signal, one of the reference drives will be turned on and the integrator in the analog section will drive back towards zero. At the same time (start of $\overline{E_R}$) the action of A1R6, A1C3, A1IC16 and A1IC19C will cause a very narrow low going pulse to be generated at A1IC19C pin 8 which will set clocked flip-flop A1IC20B. When A1IC20B pin 9 (Q) goes high it holds pin 2 and 3 of A1IC10 high which holds it in a cleared state. 100 counts later A1IC11 pin 11 will go low which is inverted and fed to the clock input of A1IC20B. A1IC20B will clock and pins 2 and 3 of A1IC10 will go low enabling it to count each of the following 100 count outputs of A1IC11. Thus we have thrown away the 100 counts required for linearity by the analog section.

The ZERO DET change generated when the analog comparator goes through zero is detected by coincidence gate A1IC15A and B. If the circuitry is traced it may be seen that A1IC15 pins 4 and 10 will go high at the end of the 100 count throwaway, that pins 5 and 9 will go high at each clock time after the start of $\overline{E_R}$, that either pin 2 or 12 is high according to the condition of A1IC7A and that pin 1 or 13 will change state at zero detect time causing either pin 6 or 8 or A1IC15 to go low. This low is coupled back to the clear input of A1IC7B which resets it and starts the $\overline{E_O}$ state. If at 40,000 counts ZERO DET has not taken place, A1IC8 will set a 4 causing pin 8 to go high and this will clock A1IC7B to the $\overline{E_O}$ state.

When A1IC7B sets the $\overline{E_O}$ state A1IC19A will generate a narrow low going pulse which is inverted and causes the SN7475N latches to store the count in the counting register. The outputs of the latches are applied to the SN7447AN decoders which drive the readouts through resistor networks A2IC1 through A2IC5.

If a 4 is strobed into A1IC6 from A1IC8 (indicating an out-of-range condition) pin 10 of A1IC6 will be high and (via A1R3) A1IC5C pin 9 will be high. Then during the 10 state cycle, any number containing a 4 will cause A1IC5C pin 8 to go low blanking the display. The other connection at pin 9 of A1IC5C goes to the battery pack and is used to make the display blink when the battery is low.

3.2.3 COUNTER OPERATION

Counter input circuit. (see schematic 8545-070, sheet 1) The input signal to the counting circuitry is coupled in through A1C8. A1R19 to the gate of FET follower A1Q6. The output of A1Q6 is coupled through A1C14 to pin 3 of A1IC34. A1R23 and A1R24 center the input swing around + 2.5 V. When centered, the arm of A1R22 is approximately + 2.5 V and this is used as a reference for comparator A1IC34. A1R22 is normally centered for sine waves but may require adjustment for square waves that have aberations which could trigger the comparator. A1R26, A1R27, A1R28 and A1C16 form a hysteresis feedback to prevent multiple triggering on low frequency sine waves.

The normal output of A1IC34 is pin 9 and this is fed through A1IC23A in the 400 KHz range to A1IC22. In the 4 MHz range the signal is counted down by 10 be A1IC24 and coupled through A1IC23D to A1IC22. In the 40 MHz range the signal is counted down by A1IC24 and again by A1IC18 and then fed to A1IC22. We will come back to this circuit later for the lower three ranges.

The output of A1IC22 is held high by A1[illegible] until the start of E_{2} time in the DMC control counter. The narrow low going pulse generated by A1IC19C will toggle A1IC23C output to the high state allowing the counter input frequency to enter the counting register.

When A1IC23C goes high A1IC21C will go low and turn off A1IC21D disconnecting the 200 KHz clock. When A1IC23C went high it also turned on A1IC21B, connecting the 100 KHz to A1IC32 which is the input to the gate generator. In the three high ranges, after 100 MS. pin 11 of A1IC26 will go high and through A1IC21A and A1IC19D will clock A1IC20A. This will cause Q of A1IC20A to go low which will shut down A1IC21C and A1IC7B. Shutting down A1IC7B will strobe the register count into the latches and A1IC21C will again connect the 200 KHz clock to continue the cycle. On the 40 KHz range the operation is much the same except that 1 second gate is generated and the output of A1IC34 is connected to A1IC22 through A1IC23B.

In the 400 Hz and 4 000 Hz range the complement output of A1IC34 is fed to phase-locked-loop A1IC35 pin 14. This will cause the VCO output at pin 4 to rise from zero toward some higher frequency. This output is buffered by A1Q7 and fed to pin 1 of A1IC2[illegible] where is counted down by 10 in the 4000 Hz range and fed back through A1IC30C and D to the phase comparator input of A1IC35. When the phase comparator input and the signal input are at the same frequency the output of the VCO will stabilize at a frequency equal to 10 times the input frequency.

In the 400 Hz range the action is the same except the frequency is multiplied by 100. The output of the VCO buffer A1Q7 is fed through A11C17A to A11C22 and is processed as a 40 KHz range signal from that point on.

3.2.4 POWER SUPPLY (refer to schematic 8545-070, sheet 1)

Diodes A1CR3 and A1CR4 rectify the output of the power transformer which is connected through power switch S2F to A1Q1 which is the pass transistor for the regulated + 5 V. If the + 5 V tends to drop toward zero this is sensed by A1R10, A1R11, and A1R12 and fed to pin 2 of A11C36. This causes the output of A11C36 to swing plus, which turns on A1Q2 harder driving more base current into A1Q1 which causes the voltage to rise back to + 5 V. This + 5 V is used to power the logic and the ± 15 supplies.

Integrated circuit A11C37 is a free running oscillator operating at approximately 27 KHz. The 27 KHz at pin 3 of A11C37 drives A1Q4 directly and A1Q5 through inverter A1Q3. The center tap of the chopper transformer is at + 5 V so by alternately pulling one end or the other of the primary to common an AC signal will be introduced in the primary. The secondary voltage is rectified and filtered and becomes the + 15 V and the - 15 V required to operate the analog section.

3.2.5 BATTERY PACK OPERATION (refer to schematic 8545-071) (DMC 45 OPTION 01 AND 01A)

The rectified DC comes onto the battery charger board on pins 1 and 2 and when S3 is in the charge position, is routed out pin 3 to the + 5 regulator in the CIMRON® DMC 45 for operation while charging.

The rectified DC is also applied to voltage regulator A3Q1. A3Q1 regulates the voltage at D and E to + 6.85 V when the battery is fully charged. A3R4, A3CR2 and A3CR3 limit the maximum charge current to 1.2 amperes at the start of the charge to protect the battery from overcurrent.

The regulator is adjusted for single battery operation by A3R3 to + 6.85 V out with the battery replaced by an 82Ω 1 watt resistor shunted by a 2,000μf capacitor. For double battery operation, the battery is replaced by a 43Ω 2 watt resistor shunted by a 2,000μf capacitor while adjusting A3R3 for + 6.85 output.

When the battery voltage is low (approximately 5 minutes before loss of instrument accuracy) pin 8 of the connector will rise to a high. This will turn on A3Q3 which will turn on A3Q2 and connect the battery voltage to pin 7. This will cause the display to blink.

3.2.6 PRINT OPERATION (DMC 45 OPTION 02)

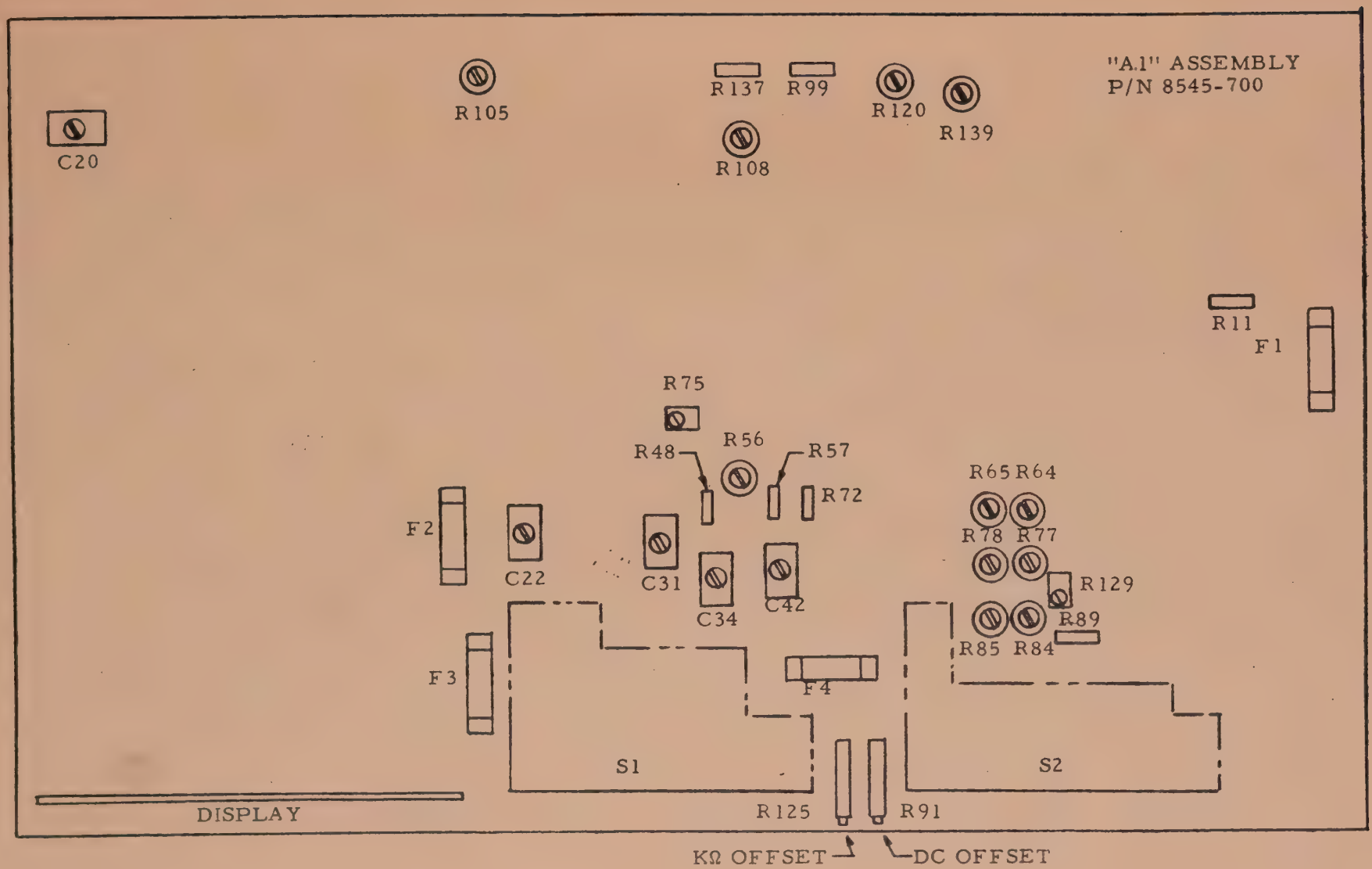
The print outputs (see Figure 3-3 for pin assignments) are low for true.

When the data ready goes low, the data is stable and will remain steady until the next data ready. This period is 500 MS, if the printer will complete its cycle within this period the inhibit input is not needed. When the print period exceeds 500 MS the DMC 45 can be made to hold by raising the inhibit line high within 100 MS of Data Gate. The high on the inhibit line must source 12 ma at + 2.1 to + 5 V. If the DMC 45 is to be operated in print only, then AIR36 can be removed and the inhibit line driven directly by DTL or TTL logic.

PRINT-OUT PIN ALLOCATION CHART

J5	
1	TEN THOUSANDS "1"
2	THOUSANDS "1"
3	TEN THOUSANDS "2"
4	THOUSANDS "2"
5	TEN THOUSANDS "4"
6	THOUSANDS "8"
7	HUNDREDS "2"
8	THOUSANDS "4"
9	TENS "8"
10	HUNDREDS "8"
11	HUNDREDS "1"
12	HUNDREDS "4"
13	TENS "1"
14	TENS "2"
15	TENS "4"
16	UNITS "1"
17	POLARITY PRINT
18	UNITS "2"
19	INHIBIT
20	UNITS "8"
21	DATA READY
22	UNITS "4"
23	GROUND
24	NO CONNECTION

FIGURE 3-3



Figure

Locations of Adjustments for

Model DMC 45 Digital Multimeter/Counter

Figure 4-1 shows the location of all internal adjustments required to calibrate the CIMRON® DMC 45.

4.1 TEST EQUIPMENT REQUIRED

a) DC Voltage Standard: COHU 351 or equivalent
b) AC Voltage Standard: HP 745/746 or equivalent
c) Frequency Counter: HP 5326A or equivalent
d) Variac: Superior Electric 216 or equivalent
e) Resistance Standards: 2KΩ, 20KΩ, 200KΩ, 2MΩ and 10MΩ ±.005%
f) Frequency Standard:

4.2 CALIBRATION PROCEDURE

4.2.1 COUNTER CALIBRATION

a) Connect the a precision frequency counter to A1IC33 pin 1 and adjust A1C20 for exactly 1 MHz on counter.

4.2.2 DMC CALIBRATION

For remainder of calibration see Table 4-1.

4.3 VERIFICATION OF SPECIFICATIONS

The following procedures should be performed only after completing the calibration procedure.

4.3.1 INPUT IMPEDANCE

Select the 4 VDC range. Apply + 1.0000 V and observe reading. Connect a 1 megohm 1% resistor in series with high input lead. The change in reading, with the resistor in, should not exceed 10 digits.

4.3.2 NORMAL MODE REJECTION

Select the 4 VDC range. Connect the input to the DMC to a sine wave generator. Connect the generator high to the DMC 45 red binding post and the generator low to the DMC 45 black and green binding posts. Set the generator to .316 volts peak-to-peak at 60 Hz. The display should read .0000 ± 5 digits.

4.3.3 COMMON MODE REJECTION

Select the .4 VDC range. Short all three input terminals of the DMC 45 together and connect them to the high side of a sine wave generator. Connect the low side of the generator to power line ground. Set the sine wave generator to 100 volts peak-to-peak at exactly 60 Hz. The readout should read .0000 ± 5 digits.

TABLE 4-1

CALIBRATION DMC 45

(REFER TO FIGURE 4-1 FOR ADJUSTMENT LOCATIONS)

Step	Function	Range	Input	Adjust (on A1 Assy)	Adjust For	Notes
1	KΩ	4000	Short	A1R129	0.0000	
2	KΩ	4000	1MΩ	A1R120	1.0000V (1)	(1) These adjustments are monitored on a DMM connected from common TP to top of current resistors. This DMM must be FET input on the 1V range.
3	DC	.4	Short	DC offset F.P.	0.0000±5	
4	DC	4	-1MV	A1R99*	-0.0010^{+0}_{-1}	
5	DC	4	+1MV	A1R137*	$+0.0010^{+0}_{-1}$	
6	DC	4	-2V	A1R108	-2.0000	
7	DC	4	+2V	A1R139	+2.0000	
8	DC	.4	Short	DC offset F.P.	+.00000	
9	DC	.4	+.2V	A1R105	+.20000±1	
10	DC	40	+20V	A1R65*	+20.000±1	
11	DC	400	+200V	A1R78*	+200.00±1	
12	DC	4000	+1000.0V	A1R85*	+1000.0±1	
13	KΩ	4000	Short	A1R129	0000.0	
14	KΩ	.4	Short	KΩ offset F.P.	.00000	
15	KΩ	4	2K	A1R84	2.0000±1	
16	KΩ	40	20K	A1R77	20.000±1	
17	KΩ	400	200	A1R64	200.00±1	
18	KΩ	40000	10M	A1R89	10.000±3	
19	AC	.4	1MV AC 1KHz	A1R75	.00100±5	Note: If DMC 45 has battery option, battery must be in place for AC adjustments.
20	AC	4000	500V 200Hz	A1R56	500.00±2	
21	AC	4000	500V 20KHz	A1C22	500.00±3	
22	AC	4	2V 500Hz	A1R48	2.0000±1	
23	AC	4	2V 50KHz	A1C31	2.0000±3	
24	AC	40	20V 500Hz	A1R57	20.000±1	
25	AC	40	20V 50KHz	AIC34	20.000±3	
26	AC	400	200V 500Hz	A1R72	200.00±1	
27	AC	400	200V 50KHz	A1C42	200.00±2	

* Note: These adjustments turn counter-clockwise for increase.

4.3.4 INPUT SENSITIVITY AND ACCURACY IN KHz FUNCTION

Select the 4000 KHz range and apply a 1 MHz ±.005% signal at 0.25 volts RMS to the input jacks. Adjust input sensitivity and level as required. The display should read 1000.0 ±5 digits.

Select the 40 MHz range and apply a 20 MHz ±.005% signal at 0.5 volts RMS to the input jacks. Adjust input sensitivity and level as required. The display should read 20,000 ± 7 digits.

Select the 400 Hz range and apply a 100 Hz ± .005% signal at 0.15 volts RMS to the input jacks. Adjust input sensitivity and level as required. The display should read + .10000 ± 4 digits.

5.1 GENERAL MAINTENANCE

The CIMRON® DMC 45 Digital Multimeter/Counter is a solid state instrument designed to give years of trouble free service. Since the instrument has no moving parts, maintenance is limited to periodic cleaning in accordance with good commercial shop practices.

5.2 TROUBLESHOOTING

Experience has shown that often the difficulties encountered with equipment are poor input signals or misinterpretation of specifications. Check that the input is not noisy and/or erratic, and that the specifications of this instrument are fully understood.

Only skilled personnel who have studied the theory or operation section of this manual should attempt to repair the instrument.

WARNING

HIGH VOLTAGE (115/230 VAC)

This equipment contains potentially lethal voltages.

DEATH

on contact may result if personnel fail to observe safety precautions.

The following is a guide to localize a malfunction:

1. Check the + 5 volt regulated output.
2. Check the + 15 and -15 volt supplies for 15±1V.
3. Check the +10 and -10 volt references for ± .2%.
4. Apply -1 V in the 4 V range and check with scope for integration wave form at right side of large .68μf capacitor at rear of instrument.
5. With above input voltage check at pin 6 of A11C42 for square wave of -1 V amplitude which is on for 100 MS and off for 400 MS.
6. Check at junction of A1R112/A1R118 for a signal that is noisy for 350 MS and stable for 150 MS. This is the auto-zero feedback.

7) Check that the comparator output at the collector of A1Q22 changes state when the integrator ramp passes through zero.

8) If the counter is inoperative, check for a pulse train at A1IC34 pin 9. This pulse train should be at the same frequency as the input signal. If the pulse train is not present, check the input circuit A1Q6, A1IC34 and associated circuit.

9) If step 8 checks good, apply a 10 KHz signal in the 40 KHz range and check for a gated pulse train at A1IC22 pin 8. If the gated pulse train is present, proceed to step 10. If the gated pulse train is not present, check the operation of flip/flop A1IC23 pin 8 and A1IC21 pin 8. A1IC28 pin 8 should be high for 1 second and then low for approximately .3 second. If the flip/flop is not operating properly, check the gate generators A1IC25 through A1IC32 for proper count down of the 1MHz clock.

10) If the counter is operating properly in the 40 KHz range and is inoperative in the higher ranges, check the operation of pre-scalers A1IC18 and A1IC24.

11) If the counter is operating in the 40 KHz range but will not phase lock in the two lower ranges, check that A1IC35 has an output at pin 4. The output at pin 4 of A1IC35 should be at least 1.5 volts in amplitude and have a frequency of 10 times the input signal when operating on the 4 KHz range and 100 times the input frequency when operating on the 400 Hz range. If the amplitude is less than 1.5V replace A1IC35.

12) If the frequency at A1IC35 pin 4 is more than 10 times the input signal when operating in the 4 KHz range or 100 times the input signal when operating in the 400 Hz range, check the signal at pin 3 of A1IC35. This signal should be equal to the input frequency. If it is not, check the operation of A1IC28, A1IC29, A1IC30C and A1IC30D.

13) If the counter is operating but the accuracy is not to specification, check the frequency of the crystal oscillator for 1 MHz ±.02%.

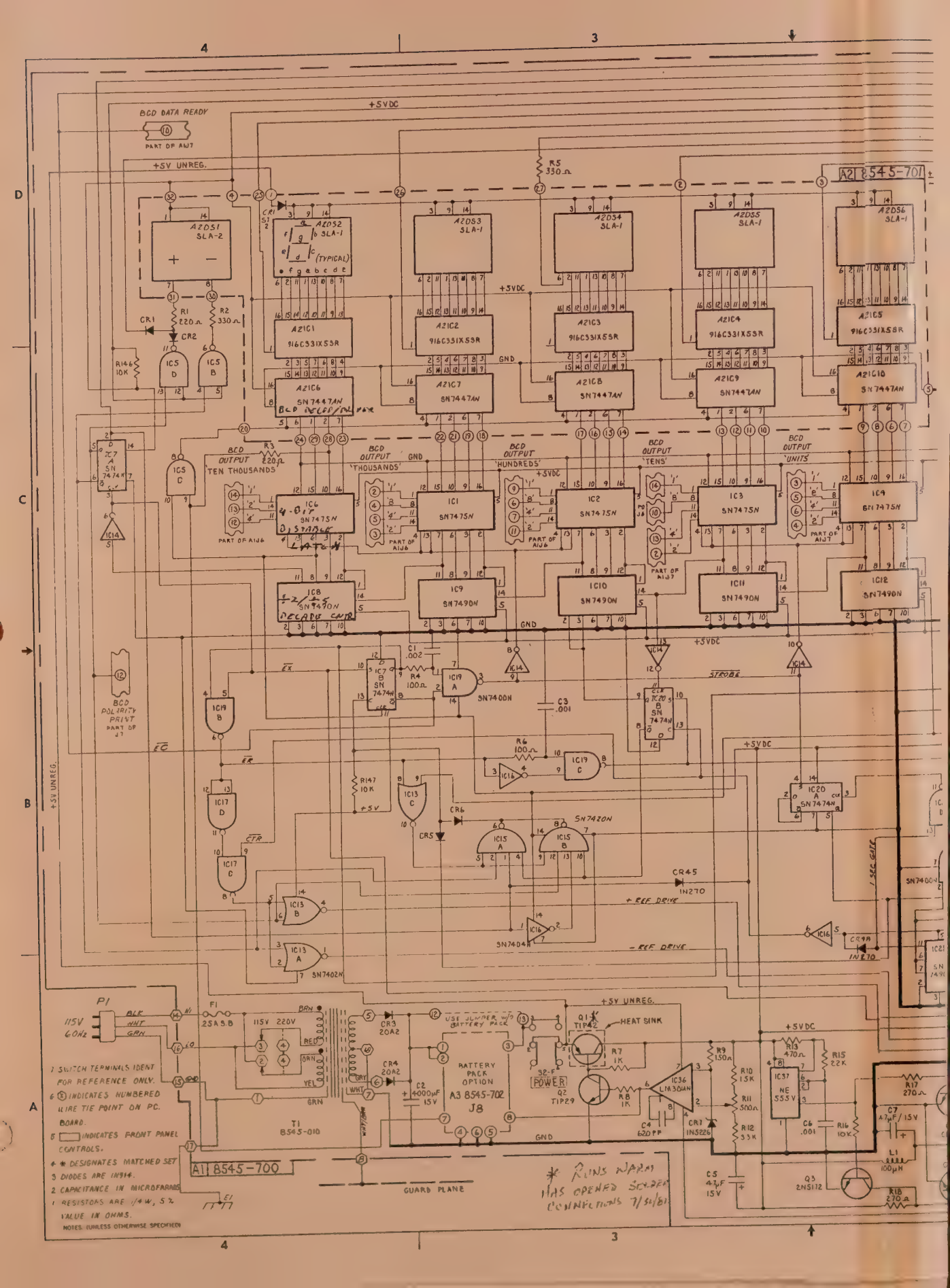
6.1 GENERAL

This section contains schematics and mechanical diagrams necessary for operation and maintenance of the Model DMC 45 Digital Multimeter/Counter. The schematic diagrams illustrate the circuit while the mechanical assemblies indicate the part placement.

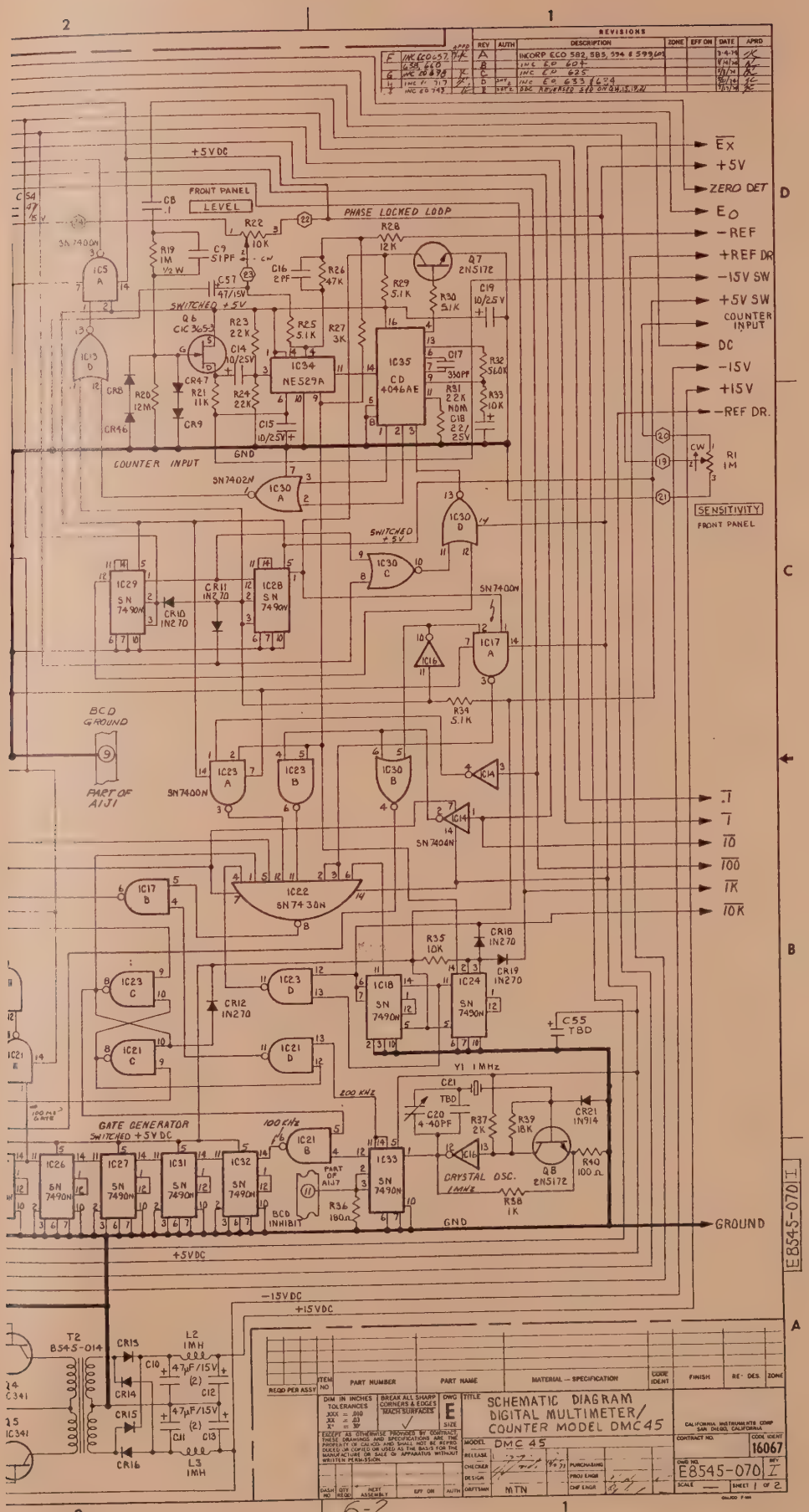
6.2 REFERENCE DESIGNATIONS

Partial reference designators are shown on schematic and mechanical drawings. Prefix these reference designators with assembly and/or sub-assembly designation for the complete reference designator. For example:

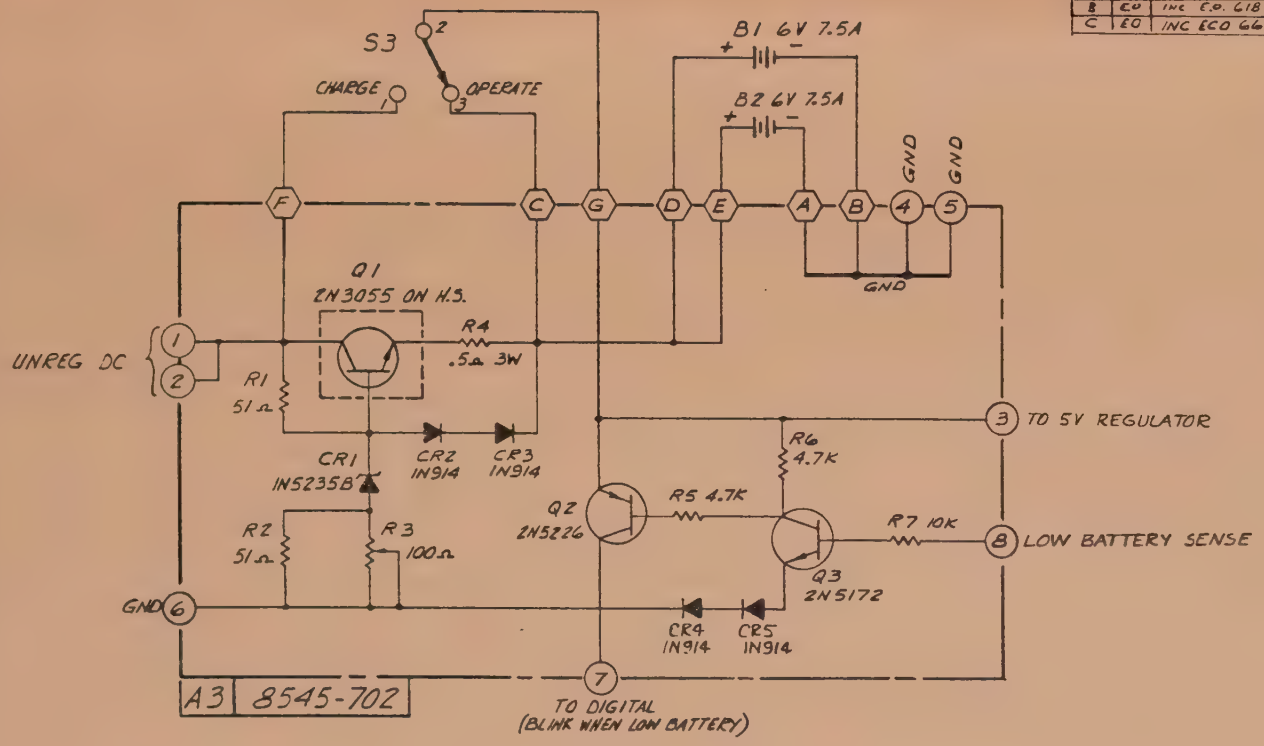
Assembly/Sub-Assembly	Component	Component Designation
A1	C8	A1C8
None	J2	J2
A3	R3	A3R3



BCD DATA READY
PART OF A1J7
+5VDC
+5V UNREG.
A2 8545-701
A2DS1 SLA-2
A2DS2 SLA-1
A2DS3 SLA-1
A2DS4 SLA-1
A2DS5 SLA-1
A2DS6 SLA-1
(TYPICAL)
A2IC1 916C331X5SR
A2IC2 916C331X5SR
A2IC3 916C331X5SR
A2IC4 916C331X5SR
A2IC5 916C331X5SR
A2IC6 SN7447AN
A2IC7 SN7447AN
A2IC8 SN7447AN
A2IC9 SN7447AN
A2IC10 SN7447AN
BCD DECODER/DRIVER
BCD OUTPUT 'TEN THOUSANDS'
BCD OUTPUT 'THOUSANDS'
BCD OUTPUT 'HUNDREDS'
BCD OUTPUT 'TENS'
BCD OUTPUT 'UNITS'
IC6 SN7475N
IC1 SN7475N
IC2 SN7475N
IC3 SN7475N
IC4 SN7475N
4-BIT DISTABLE LATCH
IC8 SN7490N
IC9 SN7490N
IC10 SN7490N
IC11 SN7490N
IC12 SN7490N
DECADE CNTR
BCD POLARITY PRINT
PART OF J7
STROBE
SN7400N
SN7420N
SN7404N
SN7402N
+ REF DRIVE
- REF DRIVE
1 SEC GATE
P1
115V 60Hz
F1 .25A S.B
115V 220V
T1 8545-010
CR3 20A2
CR4 20A2
C2 4000µF 15V
USE JUMPER W/O BATTERY PACK
BATTERY PACK OPTION
A3 8545-702
J8
Q1 TIP42
HEAT SINK
Q2 TIP29
32-F POWER
IC36 LM301AN
IC37 NE 555V
CR7 1N5226
C4 620PF
C5 47µF 15V
C6 .001
C7 47µF/15V
L1 100µH
Q3 2N5172
R17 270Ω
R18 270Ω
A1 8545-700
GUARD PLANE
1 SWITCH TERMINALS IDENT FOR REFERENCE ONLY.
6 ⊗ INDICATES NUMBERED WIRE TIE POINT ON PC. BOARD.
5 ▭ INDICATES FRONT PANEL CONTROLS.
4 * DESIGNATES MATCHED SET
3 DIODES ARE 1N914.
2 CAPACITANCE IN MICROFARADS
1 RESISTORS ARE 1/4W, 5% VALUE IN OHMS.
NOTES: (UNLESS OTHERWISE SPECIFIED)
* RUNS WARM HAS OPENED SOLDER CONNECTIONS 7/31/81


REVISIONS
REV | AUTH | DESCRIPTION | ZONE | EFF ON | DATE | APRD
A | INCORP ECO 582, 583, 594 & 599
B | INC EO 604
C | INC EO 625
D | INC EO 633 & 634
E | DSC REVERSED SEQ ON Q14, 15, 19, 21
+5VDC
FRONT PANEL
LEVEL
PHASE LOCKED LOOP
SWITCHED +5V
COUNTER INPUT
GND
SN7402N
SN7400N
SN7404N
SN7430N
BCD GROUND
PART OF A1J1
GATE GENERATOR
SWITCHED +5VDC
100 KHz
200 KHz
Y1 1MHz
CRYSTAL OSC.
1MHz
BCD INHIBIT
GROUND
-15VDC
+15VDC
Ex
+5V
ZERO DET
Eo
-REF
+REF DR
-15V SW
+5V SW
COUNTER INPUT
DC
-15V
+15V
-REF DR.
SENSITIVITY
FRONT PANEL
T2 B545-014
L2 1MH
L3 1MH
47μF/15V
E8545-070 I
SCHEMATIC DIAGRAM
DIGITAL MULTIMETER/
COUNTER MODEL DMC45
DMC 45
CALIFORNIA INSTRUMENTS CORP
SAN DIEGO, CALIFORNIA
CONTRACT NO.
CODE IDENT 16067
DWG NO. E8545-070
REV I
SCALE
SHEET 1 OF 2
MTN
6-2

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD
A	E.O.	INC E.O. 605			3/15/74	
B	E.O.	INC E.O. 618			4/4/74	JK
C	E.O.	INC ECO 660			11/8/74	JK



3. (X) INDICATE PIN ON J8 CONNECTOR
2. (X) INDICATE WIRE TIE POINT ON PC BOARD
1. RESISTORS ARE 1/4 W 5%

NOTES: (UNLESS OTHERWISE SPECIFIED)

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

DIM IN INCHES TOLERANCES .XXX = .010 .XX = .03 X° = 30'

BREAK ALL SHARP CORNERS & EDGES MACH SURFACES ✓

DWG C SIZE

TITLE SCHEMATIC DIAGRAM BATTERY CHARGER

CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

MODEL DMC 45 BAT. PACK OPTION-01

CONTRACT NO.

CODE IDENT 16067

DWG NO. C8545-071 REV C

SCALE — SHEET 1 OF 1

RELEASE

CHECKER 10/10/73

DESIGN

DRFTSMN 7/31/73

PURCHASING

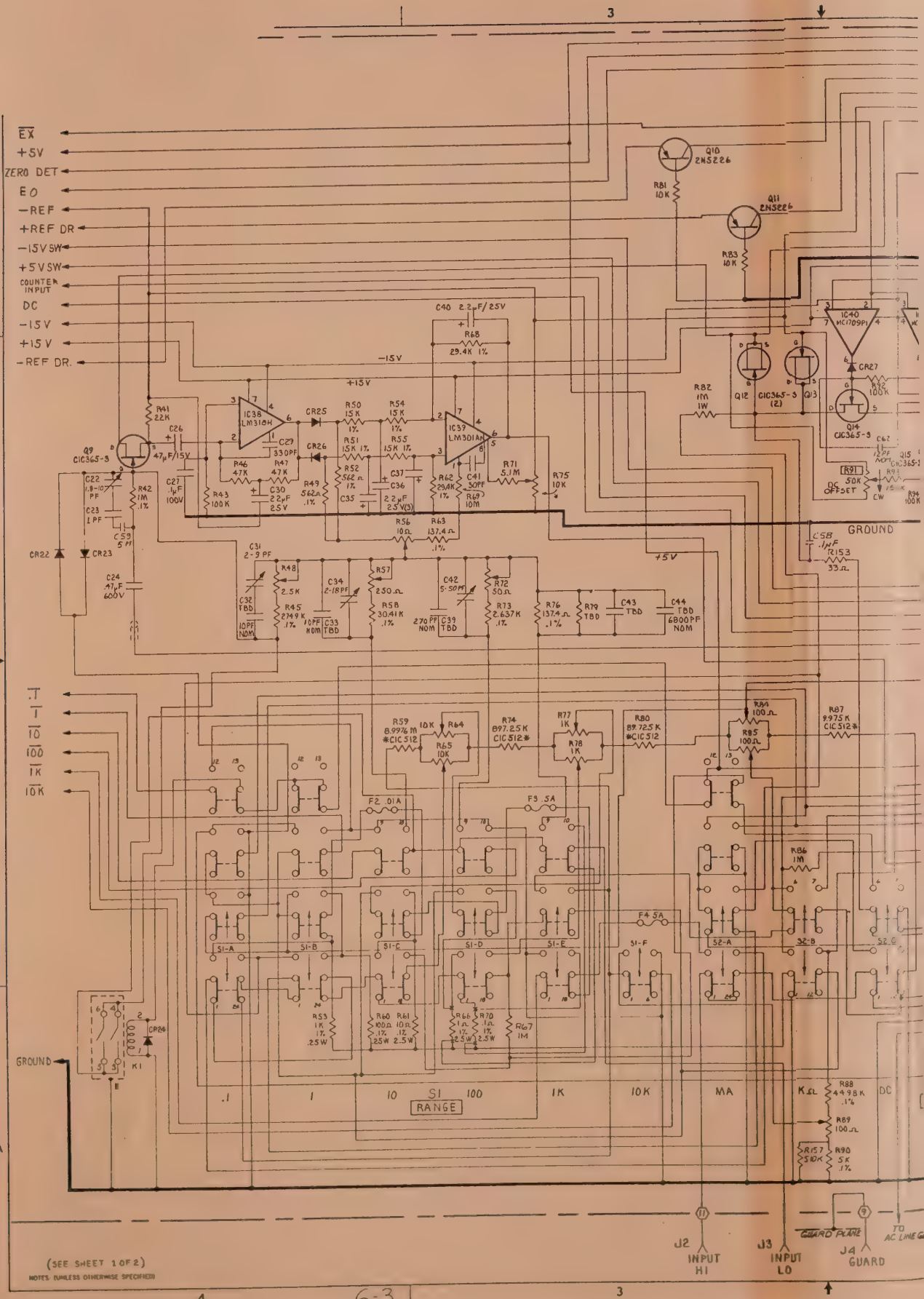
PROJ ENGR

CHF ENGR

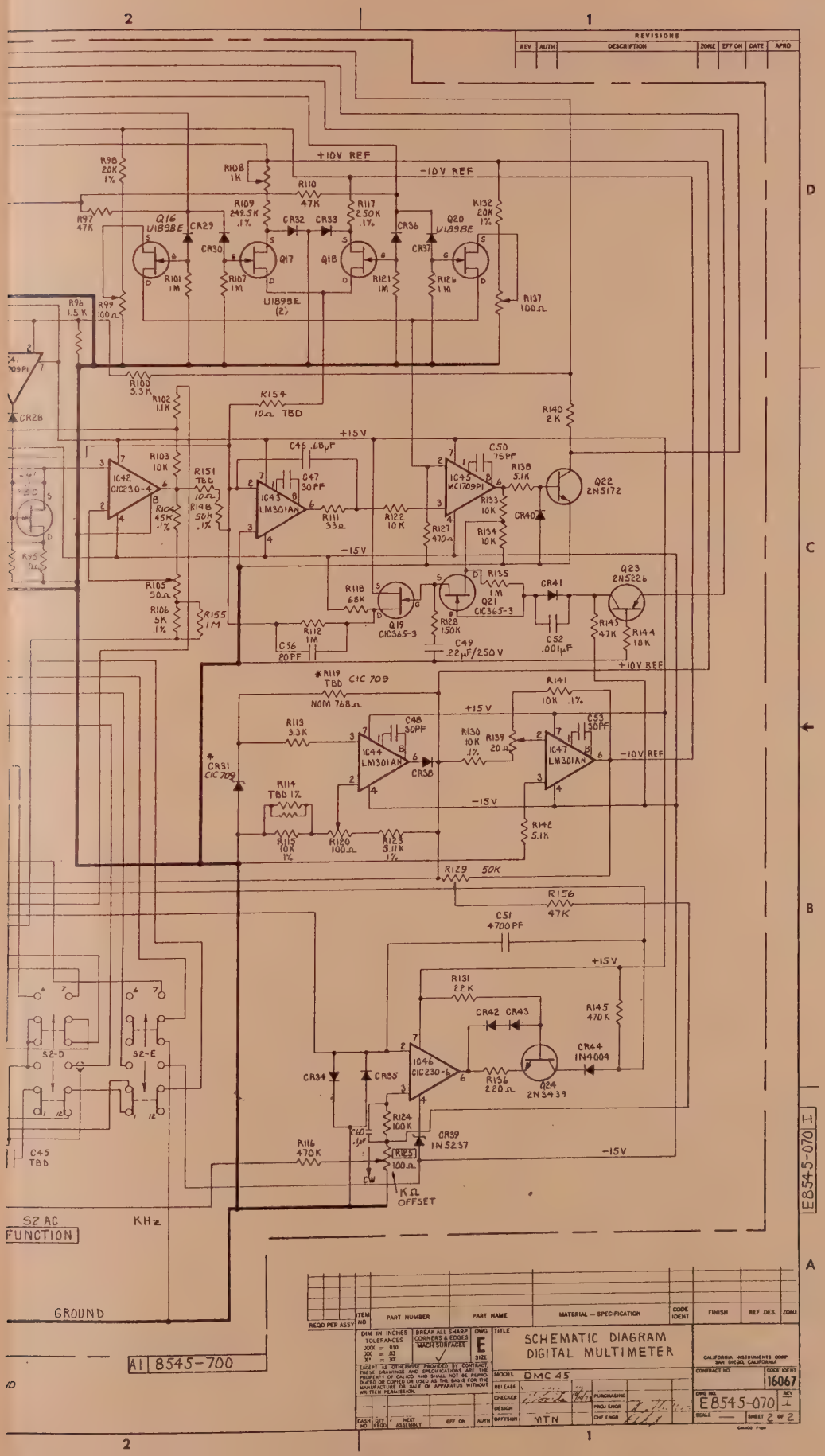
DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

CALICO F-88

C8545-071 C



EX
+5V
ZERO DET
EO
-REF
+REF DR
-15V SW
+5V SW
COUNTER INPUT
DC
-15V
+15V
-REF DR.
Q10 2N5226
Q11 2N5226
R81 10K
R83 10K
IC40 MC1709P1
CR27
R92 100K
Q12 CIC365-3 (2)
Q13
Q14 CIC365-3
R82 1M 1W
R91 50K DC OFFSET
CW
GROUND
C58 .1μF
R153 33Ω
C40 2.2μF/25V
R68 29.4K 1%
-15V
+15V
IC38 LM318H
IC39 LM301AH
CR25
CR26
R50 15K 1%
R54 15K 1%
R51 15K 1%
R55 15K 1%
R52 562Ω 1%
R49 562Ω .1%
C37
C36 2.2μF 25V(3)
C35
R62 29.4K 1%
C41 30PF
R69 10M
R71 5.1M
R75 10K
R41 22K
C26 47μF/15V
C27 .1μF 100V
R46 47K
R47 47K
C30 2.2μF 25V
R43 100K
Q9 CIC365-3
C22 1.8-10 PF
C23 1PF
R42 1M .1%
C59 5PF
CR22
CR23
C24 .47μF 600V
R56 10Ω
R63 137.4Ω .1%
C31 2-9 PF
R48 2.5K
R45 2749K .1%
C32 TBD 10PF NOM
C34 2-18PF
C33 TBD 10PF NOM
R57 250Ω
R58 30.41K .1%
C42 5-50PF
C39 TBD 270PF NOM
R72 50Ω
R73 2.637K .1%
R76 137.4Ω .1%
R79 TBD
C43 TBD
C44 TBD 6800PF NOM
+5V
.1
1
10
100
1K
10K
R59 8.9976M *CIC512
R64 10K
R65 10K
R74 897.25K CIC512*
R77 1K
R78 1K
R80 89.725K *CIC512
R84 100Ω
R85 100Ω
R87 9.975K CIC512*
F2 .01A
F3 .5A
F4 5A
R86 1M
S1-A
S1-B
S1-C
S1-D
S1-E
S1-F
S2-A
S2-B
S2-C
R53 1K 1% .25W
R60 100Ω .1% .25W
R61 10Ω .1% 2.5W
R66 1Ω 1% 2.5W
R70 1Ω 1% 2.5W
R67 1M
CR24
K1
GROUND
.1
1
10
S1
100
1K
10K
MA
KΩ
RANGE
R88 4498K .1%
R89 100Ω
R157 510K
R90 5K .1%
DC
J2 INPUT HI
J3 INPUT LO
J4 GUARD
GUARD PLANE
TO AC LINE
(SEE SHEET 1 OF 2)
NOTES: (UNLESS OTHERWISE SPECIFIED)


REVISIONS
REV AUTH DESCRIPTION ZONE EFF ON DATE APRD
+10V REF
-10V REF
R98 20K 1%
R97 47K
R108 1K
R110 47K
R109 249.5K .1%
R117 2.50K .1%
R132 20K 1%
Q16 U1898E
Q17
Q18
Q20 U1898E
CR29
CR30
CR32
CR33
CR36
CR37
R101 1M
R107 1M
R121 1M
R126 1M
U1898E (2)
R137 100Ω
R96 1.5K
R99 100Ω
R100 3.3K
R102 1.1K
R154 10Ω TBD
R140 2K
+15V
C46 .68μF
C47 30PF
C50 75PF
R138 5.1K
Q22 2N5172
IC42 CIC230-4
IC43 LM301AN
IC45 MC1709PI
R103 10K
R151 TBD 10Ω
R104 45K .1%
R148 50K .1%
R111 33Ω
R122 10K
R133 10K
R127 470Ω
R134 10K
CR40
-15V
R105 50Ω
R106 5K .1%
R155 1M
R118 68K
Q19 CIC365-3
Q21 CIC365-3
R135 1M
CR41
Q23 2N5226
R128 150K
C49 .22μF/250V
C52 .001μF
R143 47K
R144 10K
R112 1M
C56 20PF
+10V REF
*R119 TBD CIC 709
NOM 768Ω
R141 10K .1%
+15V
R113 3.3K
C48 30PF
IC44 LM301AN
R130 10K .1%
R159 20Ω
C53 30PF
IC47 LM301AN
-10V REF
CR31 CIC 709
CR38
R114 TBD 1%
-15V
R115 10K 1%
R120 100Ω
R123 3.11K .1%
R142 5.1K
R129 50K
R156 47K
C51 4700PF
+15V
R131 22K
CR42 CR43
R145 470K
CR44 1N4004
IC46 CIC230-6
R136 220Ω
Q24 2N3439
CR34
CR35
R124 100K
C10 .1μF
CR39 1N5237
R116 470K
R125 100Ω
-15V
KΩ OFFSET
S2-D
S2-E
C45 TBD
S2 AC FUNCTION
KHz
GROUND
E8545-070 I
A1 8545-700
REQD PER ASSY
ITEM NO
PART NUMBER
PART NAME
MATERIAL — SPECIFICATION
CODE IDENT
FINISH
REF DES.
ZONE
DIM IN INCHES TOLERANCES XXX = .010 XX = .03 X° = 30°
BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES
DWG SIZE E
TITLE
SCHEMATIC DIAGRAM
DIGITAL MULTIMETER
CALIFORNIA INSTRUMENTS CORP SAN DIEGO, CALIFORNIA
CONTRACT NO.
CODE IDENT 16067
MODEL DMC 45
RELEASE
CHECKER
DESIGN
DRFTSMN MTN
PURCHASING
PROJ ENGR
CHF ENGR
DWG NO. E8545-070
REV I
SCALE —
SHEET 2 OF 2
DASH NO
QTY REQD
NEXT ASSEMBLY
EFF ON
AUTH

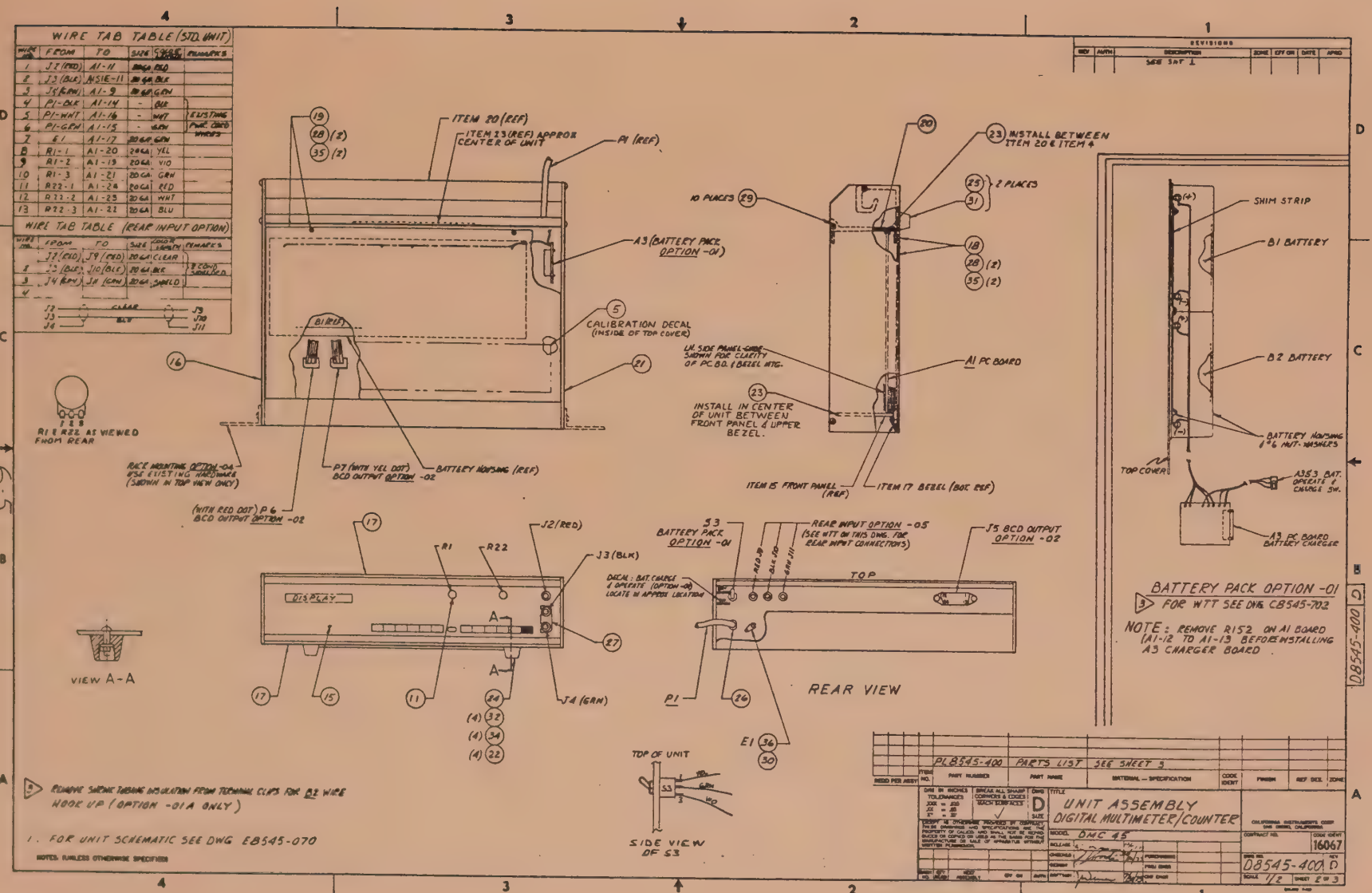
WIRE TAB TABLE (STD. UNIT)

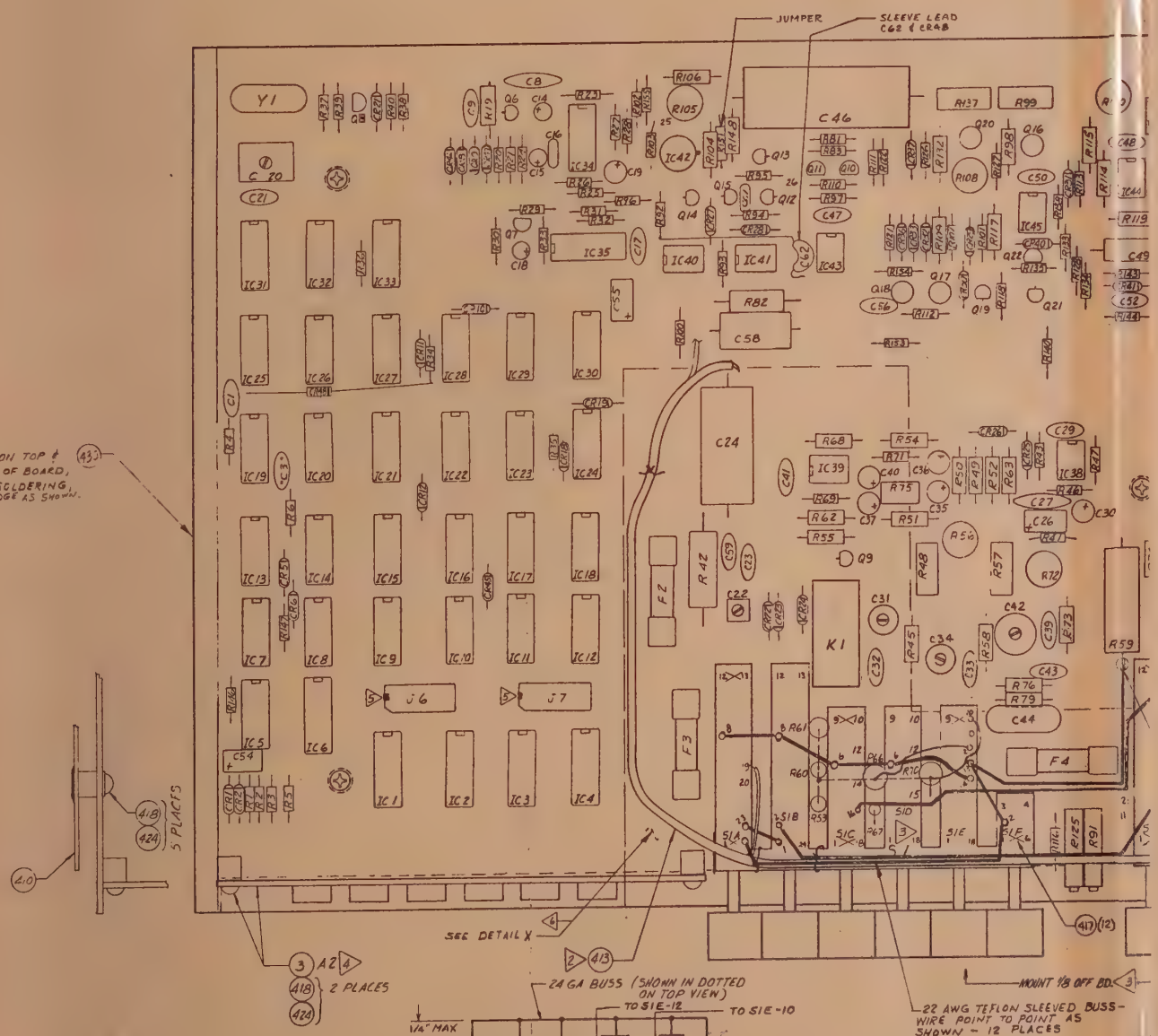
WIRE NO.	FROM	TO	SIZE	COLOR & LENGTH	REMARKS
1	J1 (RED)	A1-11	20 GA	RED	
2	J3 (BLK)	A5E1E-11	20 GA	BLK	
3	J5 (GRN)	A1-9	20 GA	GRN	
4	P1-BLK	A1-14	-	BLK	
5	P1-WHT	A1-16	-	WHT	EXISTING
6	P1-GRN	A1-15	-	GRN	PWR. CORD
7	E1	A1-17	20 GA	GRN	WIRES
8	R1-1	A1-20	20 GA	YEL	
9	R1-2	A1-19	20 GA	VIO	
10	R1-3	A1-21	20 GA	GRN	
11	R22-1	A1-24	20 GA	RED	
12	R22-2	A1-23	20 GA	WHT	
13	R22-3	A1-22	20 GA	BLU	

WIRE TAB TABLE (REAR INPUT OPTION)

WIRE NO.	FROM	TO	SIZE	COLOR & LENGTH	REMARKS
1	J2 (RED)	J9 (RED)	20 GA	CLEAR	
2	J3 (BLK)	J10 (BLK)	20 GA	BLK	2 CONDUCTOR SHIELDED
3	J4 (GRN)	J11 (GRN)	20 GA	SHIELD	
4					

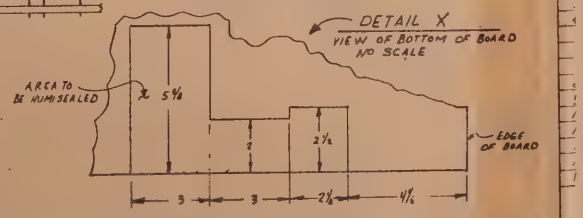
J2 — CLEAR — J9
J3 — BLK — J10
J4 — J11





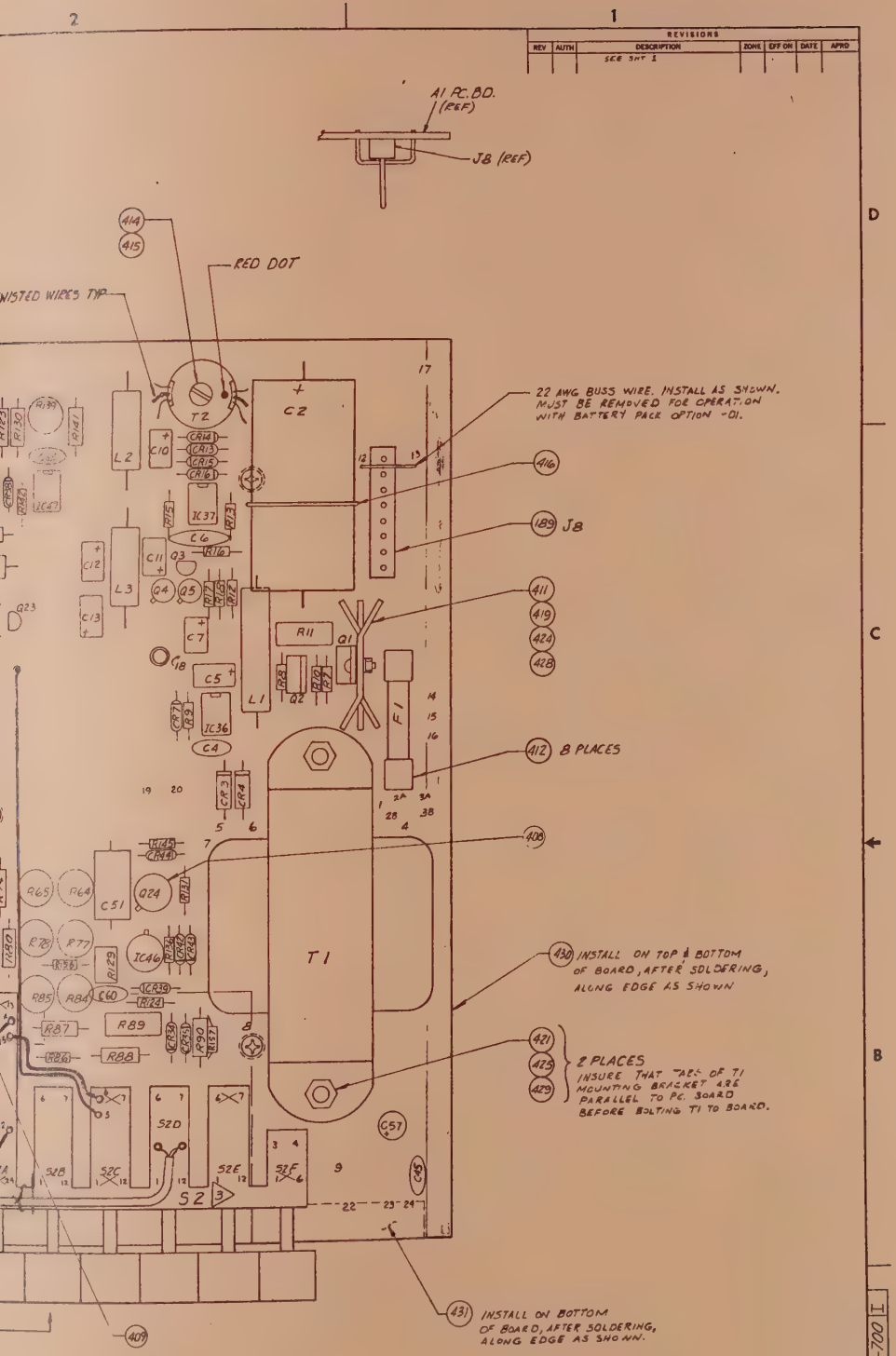
-1 P.C. BOARD ASSY

COMPONENT SIDE
(CLAD SHOWN IS FAR SIDE)



6. ADD HUMISEAL TO AREA DEFINED BY DETAIL "X" AFTER 12 HPS @ 45°C, USING A SPRAY MASK.
5. MARKING: J6 RED & J7 YELLOW IN AREA SHOWN (USE PAINT)
4. POINT TO POINT SOLDER A2 (DISPLAY BD.) TO A1 (MAIN BD.)
3. MOUNT PUSH BUTTON SWITCHES S1 & S2 .125" OFF BOARD, (USING ITEM 417) WITH LATCHING SPRINGS LOCATED AS SHOWN
2. WIRE SHALL BE ROUTED & SECURED IN PLACE (USING NYLON TIE WRAP) AS SHOWN
1. FOR SCHEMATIC DIAGRAM SEE E8545-070 (SHT. 1 & 2)

NOTES: (UNLESS OTHERWISE SPECIFIED)



REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD
		SEE SHT 1				

WIRE TABLE

	FROM	TO	REMARKS
	T1-BRN	A1-2A	
	T1-RED	A1-3B	FOR 115V
	T1-ORN	A1-2B	OPERATION
	T1-YEL	A1-3A	
	T1-GRN	A1-1	
	T1-BLU	A1-5	
	T1-VIO	A1-18	
	T1-GRY	A1-6	
	T1-WHT	A1-7	
	T1-W/BRN	A1-8	
	A1-12	A1-13	#22 GA BUSS
	T1-RED	A1-4	FOR 220V
	T1-ORN	A1-4	OPERATION
	S1-A19	A1-26	#24 GA BLACK

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
		PL8545-700	PARTS LIST	SHEETS 4 THRU 15				

DIM IN INCHES TOLERANCES: .XX = .010, .XX = .03, .X = .10; BREAK ALL SHARP CORNERS & EDGES; MACH SURFACES ✓

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT THESE DRAWING AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

DWG SIZE: E

TITLE: P.C. BOARD ASSEMBLY DIGITAL MULTIMETER(A1)

MODEL: DMC 45

RELEASE: [illegible] 7-3

CHECKER: [illegible] 7-3

DESIGN: PURCHASING: PROJ ENGR: OP ENGR:

DRAFTSMAN: [illegible] 8/1/65

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH
-1	1	E8545-400		

CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

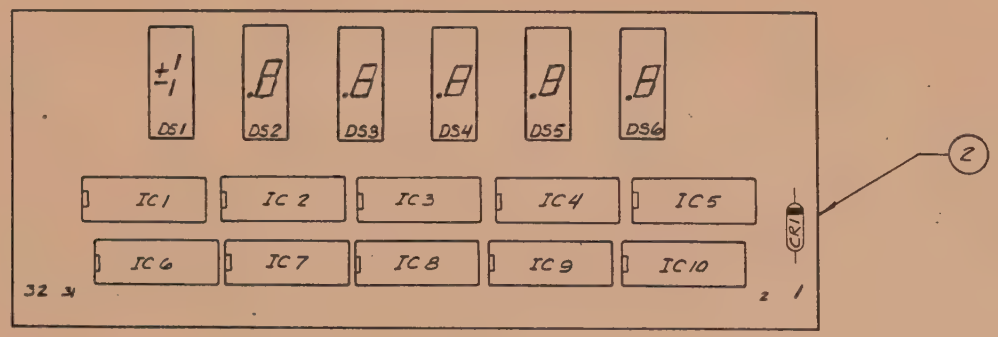
CONTRACT NO.: CODE IDENT: 16067

DWG NO.: E8545-700 REV: I

SCALE: 2:1 SHEET 2 OF 15

E8545-700 I

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD



-1 ASSY
VIEW COMPONENT SIDE

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
		PL8545-701-1	PARTS LIST	SHEET 4				

DIM IN INCHES TOLERANCES .XXX = .010 .XX = .03 X° = 30'
BREAK ALL SHARP CORNERS & EDGES MACH SURFACES ✓
DWG SIZE C

TITLE PC BOARD ASSY A2 DISPLAY

MODEL DMC 45

RELEASE 10/9/73
CHECKER 10/10/73
DESIGN
DRFTSMN 10/10/73
PURCHASING
PROJ ENGR
CHF ENGR

CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA
CONTRACT NO.
CODE IDENT 16067
DWG NO. C8545-701
REV A
SCALE 2:1
SHEET 2 OF 4

DASH NO	QTY PER 701	NEXT ASSEMBLY	EFF ON	AUTH
-1	1	8545-700		

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1. FOR SCHEMATIC DIAGRAM SEE DWG. E8545-070

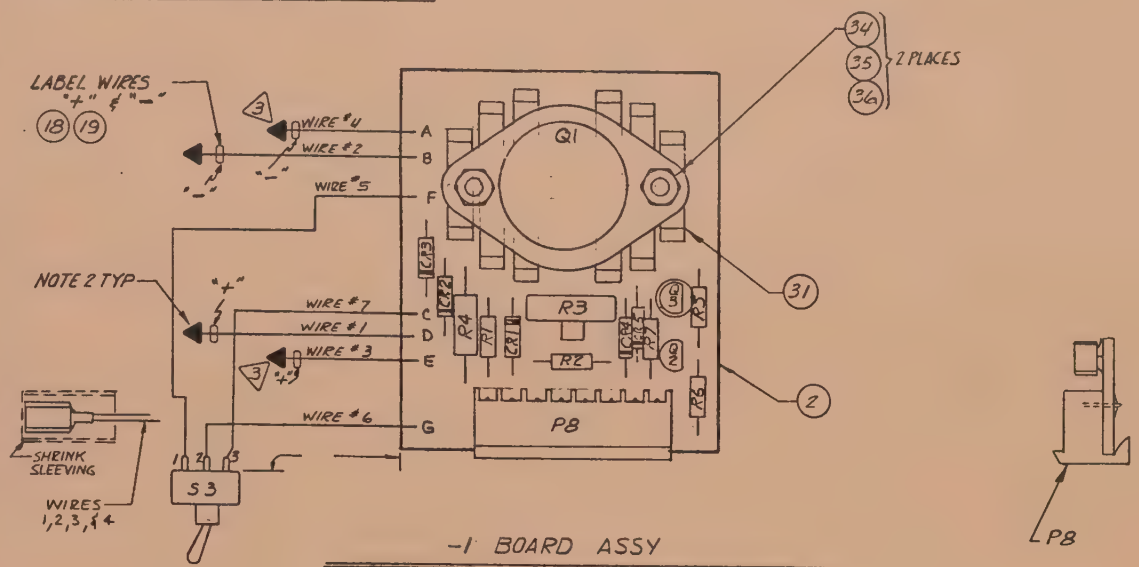
NOTES: (UNLESS OTHERWISE SPECIFIED)

6-7

C8545-701 A

WIRE TAB TABLE

WIRE NO.	FROM	TO	AWG	COLOR, LENGTH	REMARKS
1	A3-D	B1-(+) 2a	20	RED	NOTE 2
2	A3-B	B1-(-) 2b	20	BLK	NOTE 2
3	A3-E	B2-(+) 2a	20	RED	NOTE 2,3
4	A3-A	B2-(-) 2b	20	BLK	NOTE 2,3
5	A3-F	S3-1	20	YEL	
6	A3-G	S3-2	20	GRN	
7	A3-C	S3-3	20	VIO	



-1 BOARD ASSY

VIEW- COMPONENT SIDE

3 INSTALL SHRINK TUBING OVER EXPOSED PART OF TERMINAL CLIP

2. TERMINATE AT FLAGGED END USING TERMINAL CLIP LISTED BELOW OR APPROVED EQUIVALENT

2a USE TERMINAL CLIP # RA18-205, ITEM No. 32 AND SHRINK SLEEVING

2b USE TERMINAL CLIP # RA18-188, ITEM No. 33 AND SHRINK SLEEVING

1. FOR SCHEMATIC DIAGRAM, SEE DRAWING C8545-071.

NOTES: (UNLESS OTHERWISE SPECIFIED)

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
	1	8545-702-1	PARTS LIST	SEE SHEET 4				

DIM IN INCHES TOLERANCES .XXX = .010 .XX = .03 X° = 30'

BREAK ALL SHARP CORNERS & EDGES MACH SURFACES ✓

DWG SIZE C

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

TITLE: PC BOARD ASSEMBLY, BATTERY CHARGER

MODEL: DMC 45

RELEASE: [signature] 9-1-73

CHECKER: [signature] 10/10/73

DESIGN:

DRFTSMN: M. MARTIN 6-27-73

PURCHASING

PROJ ENGR

CHF ENGR

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

CONTRACT NO.

CODE IDENT 16067

DWG NO. C8545-702 REV D

SCALE 2X SHEET 2 OF 4

CALICO F-[illegible]

REVISIONS

REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD

C8545-702 D

6-8

7.1 GENERAL

This section contains ordering information and complete list of replaceable parts. Parts are listed by major assembly in alphanumerical order of their reference designators. Description, manufacturers' part number, manufacturers' code ident number (see Appendix A for list of manufacturers), and CALIFORNIA INSTRUMENTS stock numbers are indicated.

7.2 ORDERING INFORMATION

In order to provide our customers with prompt service on replacement parts, please provide the following information, when applicable, for each part ordered:

a) Model number and serial number of the instrument,

b) CALIFORNIA INSTRUMENTS part number of the subassembly where component is located,

c) Component reference designator,

d) Component description,

e) Component manufacturers' number and code ident,

f) CALIFORNIA INSTRUMENTS stock number.

All replacement parts orders should be placed with CALIFORNIA INSTRUMENTS COMPANY, a division of Aiken Industries, San Diego, California, 92111.

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	D8545-400-1	UNIT TOP ASSEMBLY	16067		1
					2
					3
A1	8545-700-1	P.C. BOARD ASSEMBLY	16067		4
	8545-102	DECAL -CALIB. PROCEDURE	16067	2-10493	5
J1	NOT USED				6
J2	3760-RED	BINDING POST	05276	2-50200	7
J3	3760-BLK	BINDING POST	05276	2-50201	8
J4	3760-GRN	BINDING POST	05276	2-50202	9
R22	8545-016-1	POTENTIOMETER 10K	16067	5-70211	10
	020-122	KNOB	0000K	2-10386	11
P1	17237	POWER CORD	70903	2-50203	12
R1	8545-016-2	POTENTIOMETER 1M	16067	5-70212	13
					14
	C8545-204-7	FRONT PANEL	16067	2-10478	15
	C8545-205-7	SIDE PANEL (LEFT)	16067	1-10400	16
	B8545-206-7	BEZEL, TOP-BOT.	16067	1-10401	17
	D8545-207-8	COVER, BOTTOM	16067	1-10403	18
	D8545-207-9	COVER, TOP	16067	1-10404	19
	D8545-208-8	REAR PANEL	16067	1-10406	20
	C8545-205-8	SIDE PANEL (RIGHT)	16067	1-10413	21
	#632 1/4" HEX	NUT			22
	1/8 DIA x 6" LG	SHRINK. TUBING			23
	10" BAIL SET	BAIL	21604	2-10351	24
	2091	RUBBER FEET	08065	2-10146	25
	SR-5L-1	STRAIN RELIEF	28520	2-10480	26
	327	SHORTING STRAP	83330	2-50159	27
	C8091-632	NUT CLIP	78553	2-10484	28
	8-32 x 3/4 LG	TYPE F THD. CUTTING SCREW P.H.	45722	2-10481	29
	#6-20 x 1/4 LG	TYPE B SCREW SELFTAP. P.H.	45722	2-10152	30
	#6-20 x 3/8 LG	TYPE B SCREW SELFTAP. P.H.	45722	2-10231	31
	6-32 x 7/16 LG	SCREW, PAN HD			32
					33
	#6	WASHER, INT. STR			34
	6-32 x 1/4 LG	SCREW, PAN HD.			35
E1	1416-6	SOLDER LUG	83330	2-50047	36

MODEL DMC 45 | CALICO P/N 8545-400 | ASSY R.D.

TITLE UNIT ASSEMBLY | SHT 3 OF 3

SAN DIEGO, CALIFORNIA | 16067 | PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1	E8545-700-1	P.C. BOARD ASSY	16067		1
	-7	P.C. BOARD MECH	16067	1-60191	2
A2	C8545-701-1	DISPLAY BOARD	16067		3
					4
					5
A1C1	5GA-D20	CAPACITOR .002μF 1KV	56289	6-10055	6
A1C2	39D408G015GL4	CAPACITOR 4000μF 15V	56289	6-10631	7
A1C3	5HK-D10	CAPACITOR .001μF 1KV	56289	6-10062	8
A1C4	DM15-621J	CAPACITOR 620PF 300V	72136	6-10873	9
A1C5	T368C476M015AS	CAPACITOR 47μF 15V	05397	6-10877	10
A1C6	5HK-D10	CAPACITOR .001μF 1KV	56289	6-10062	11
A1C7	T368C476M015AS	CAPACITOR 47μF 15V	05397	6-10877	12
A1C8	5HK-P10	CAPACITOR .1μF 500V	56289	6-10821	13
A1C9	CM05E510J03	CAPACITOR 51PF 500V	81349	6-10016	14
A1C10	T362C226M025AS	CAPACITOR 22μF 25V	05397	6-10746	15
A1C11	T362C226M025AS	CAPACITOR 22μF 25V	05397	6-10746	16
A1C12	T362C226M025AS	CAPACITOR 22μF 25V	05397	6-10746	17
A1C13	T362C226M025AS	CAPACITOR 22μF 25V	05397	6-10746	18
A1C14	T368B106M025AS	CAPACITOR 10μF 25V	05397	6-10738	19
A1C15	T368B106M025AS	CAPACITOR 10μF 25V	05397	6-10738	20
A1C16	DM10-020	CAPACITOR 2PF 500V	72136	6-10001	21
A1C17	CM05F331J03	CAPACITOR 330PF 500V	81349	6-10042	22
A1C18	T368B225M025AS	CAPACITOR 2.2μF 25V	05397	6-10798	23
A1C19	T368B106M025AS	CAPACITOR 10μF 25V	05397	6-10738	24
A1C20	403	CAPACITOR, VAR. 4-40PF	72136	6-10410	25
A1C21	CM05 T.B.D.	CAPACITOR T.B.D.			26
A1C22	222-809-05002	CAPACITOR, VAR. 1.8-10PF	73445	6-10940	27
A1C23	CM05CD010D03	CAPACITOR 1PF 500V	72136	6-10905	28
A1C24	ZA2G474	CAPACITOR .47μF 600V	27556	6-10878	29
A1C25	NOT USED				30
A1C26	T368C476M015AS	CAPACITOR 47μF 15V	05397	6-10877	31
A1C27	TG-P10	CAPACITOR .1μF 100V	56289	6-10127	32
A1C28	NOT USED				33
A1C29	CM05F331J03	CAPACITOR 330PF 500V	81349	6-10042	34
A1C30	T368B225M025AS	CAPACITOR 2.2μF 25V	05397	6-10798	35
A1C31	HT10KA/29	CAPACITOR, VAR. 2-9PF	73445	6-10975	36

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P.C. BOARD ASSEMBLY | SHT 4 OF 15

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1C32	CM05C100J03	CAPACITOR 10PF 500V	81349	6-10004	37
A1C33	CM05E100J03	CAPACITOR 10PF 500V	81349	6-10004	38
A1C34	HT10KA/218	CAPACITOR, VAR. 2-18PF	73445	6-10943	39
A1C35	T368B225M025AS	CAPACITOR 2.2μF 25V	05397	6-10798	40
A1C36	T368B225M025AS	CAPACITOR 2.2μF 25V	05397	6-10798	41
A1C37	T368B225M025AS	CAPACITOR 2.2μF 25V	05397	6-10798	42
A1C38	NOT USED				43
A1C39	CM05TBD	CAPACITOR T.B.D.	81349		44
A1C40	T368B225M025AS	CAPACITOR 2.2μF 25V	05397	6-10798	45
A1C41	CM05E300J03	CAPACITOR 30PF 500V	81349	6-10263	46
A1C42	HT10MA/550	CAPACITOR, VAR. 5-50PF	73445	6-10919	47
A1C43	CM05 T.B.D.	CAPACITOR T.B.D.			48
A1C44	DM19-682J	CAPACITOR 6800PF 100V	72136	6-10884	49
A1C45	CM05 T.B.D.	CAPACITOR T.B.D.			50
A1C46	PA2A684K	CAPACITOR .68μF 50V	27556	6-10880	51
A1C47	CM05E300J03	CAPACITOR 30PF 500V	81349	6-10263	52
A1C48	CM05E300J03	CAPACITOR 30PF 500V	81349	6-10263	53
A1C49	C280AE/A220K	CAPACITOR .22μF 250V	73445	6-10881	54
A1C50	CM05E750J03	CAPACITOR 750PF 500V	81349	6-10020	55
A1C51	SX247	CAPACITOR 4700PF 600V	90201	6-10879	56
A1C52	5HK-D10	CAPACITOR .001μF 1KV	56289	6-10062	57
A1C53	CM05E300J03	CAPACITOR 30PF 500V	81349	6-10263	58
A1C54	T368C476M015AS	CAPACITOR 47μF 15V	05397	6-10877	59
A1C55	T368 T.B.D.	CAPACITOR T.B.D.			60
A1C56	CM05E200J03	CAPACITOR 20PF 500V	81349	6-10008	61
A1C57	T368C476M015AS	CAPACITOR .47μF 15V	05397	6-10877	62
A1C58	PD5A104K	CAPACITOR .1μF 50V	12406	6-10958	63
A1C59	CM05C050D03	CAPACITOR 5PF 500V	81349	6-10483	64
A1C60	TG-P10	CAPACITOR .1μF 100V	56289	6-10127	65
A1C61	TBD	CAPACITOR TBD	81349		66
A1C62	TBD	CAPACITOR TBD			67
					68
					69
					70
					71
					72

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P.C. BOARD ASSEMBLY | SHT 5 OF 15

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1CR1	1N914	DIODE	07910	3-10118	73
A1CR2	1N914	DIODE	07910	3-10118	74
A1CR3	20A2	DIODE	07716	3-10213	75
A1CR4	20A2	DIODE	07716	3-10213	76
A1CR5	1N914	DIODE	07910	3-10118	77
A1CR6	1N914	DIODE	07910	3-10118	78
A1CR7	1N5226	DIODE, ZENER	81349	3-10222	79
A1CR8	1N914	DIODE	07910	3-10118	80
A1CR9	1N914	DIODE	07910	3-10118	[illegible]
A1CR10	1N270	DIODE	81349	3-10006	82
A1CR11	1N270	DIODE	81349	3-10006	83
A1CR12	1N270	DIODE	81349	3-10006	84
A1CR13	1N914	DIODE	07910	3-10118	85
A1CR14	1N914	DIODE	07910	3-10118	86
A1CR15	1N914	DIODE	07910	3-10118	87
A1CR16	1N914	DIODE	07910	3-10118	88
A1CR17	NOT USED				89
A1CR18	1N270	DIODE	81349	3-10006	90
A1CR19	1N270	DIODE	81349	3-10006	91
A1CR20	NOT USED				92
A1CR21	1N914	DIODE	07910	3-10118	93
A1CR22	1N914	DIODE	07910	3-10118	94
A1CR23	1N914	DIODE	07910	3-10118	95
A1CR24	1N914	DIODE	07910	3-10118	[illegible]
A1CR25	1N914	DIODE	07910	3-10118	97
A1CR26	1N914	DIODE	07910	3-10118	98
A1CR27	1N914	DIODE	07910	3-10118	99
A1CR28	1N914	DIODE	07910	3-10118	100
A1CR29	1N914	DIODE	07910	3-10118	101
A1CR30	1N914	DIODE	07910	3-10118	102
A1CR31	CIC-709-1 (BRN)	DIODE, REF., KIT	16067	3-10225	103
A1CR32	1N914	DIODE	07910	3-10118	104
A1CR33	1N914	DIODE	07910	3-10118	105
A1CR34	1N914	DIODE	07910	3-10118	106
A1CR35	1N914	DIODE	07910	3-10118	107
A1CR36	1N914	DIODE	07910	3-10118	108

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P.C. BOARD ASSEMBLY | SHT 6 OF 15

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1CR37	1N914	DIODE	07910	3-10118	109
A1CR38	1N914	DIODE	07910	3-10118	110
A1CR39	1N5237	DIODE	81349	3-10223	111
A1CR40	1N914	DIODE	07910	3-10118	112
A1CR41	1N914	DIODE	07910	3-10118	113
A1CR42	1N914	DIODE	07910	3-10118	114
A1CR43	1N914	DIODE	07910	3-10118	115
A1CR44	1N4004	DIODE	04713	3-10062	116
A1CR45	1N270	DIODE	81349	3-10006	117
A1CR46	1N914	DIODE	07910	3-10118	118
A1CR47	1N914	DIODE	07910	3-10118	119
A1CR48	1N270	DIODE	81349	3-10006	120
					121
					122
					123
A1F1*	313.250 (115V only)	FUSE .25A S.B. 125V	75915	2-40258	124
A1F2	AGX-1/100A	FUSE .01AMP 250V	71400	2-40282	125
A1F3	AGX-1/2A	FUSE .5 AMP 250V	71400	2-40362	126
A1F4	AGX-5A	FUSE 5 AMP 125V	71400	2-70041	127
	* FOR 230V INPUT	USE P/N 313.125S 1/8A	75915	2-70043	128
					129
					130
					131
A1IC1	SN7475N	INTEGRATED CIRCUIT	01295	3-60004	132
A1IC2	SN7475N	INTEGRATED CIRCUIT	01295	3-60004	133
A1IC3	SN7475N	INTEGRATED CIRCUIT	01295	3-60004	134
A1IC4	SN7475N	INTEGRATED CIRCUIT	01295	3-60004	135
A1IC5	SN7400N	INTEGRATED CIRCUIT	27014	3-60000	136
A1IC6	SN7475N	INTEGRATED CIRCUIT	01295	3-60004	137
A1IC7	SN7474N	INTEGRATED CIRCUIT	27014	3-60025	138
A1IC8	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	139
A1IC9	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	140
A1IC10	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	141
A1IC11	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	142
A1IC12	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	143
A1IC13	SN7402N	INTEGRATED CIRCUIT	27014	3-60001	144

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P.C. BOARD ASSEMBLY | SHT 7 OF 15

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1IC14	SN7404N	INTEGRATED CIRCUIT	27014	3-60002	145
A1IC15	SN7420N	INTEGRATED CIRCUIT	27014	3-60012	146
A1IC16	SN7404N	INTEGRATED CIRCUIT	27014	3-60002	147
A1IC17	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	148
A1IC18	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	149
A1IC19	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	150
A1IC20	SN7474N	INTEGRATED CIRCUIT	27014	3-60025	151
A1IC21	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	152
A1IC22	SN7430N	INTEGRATED CIRCUIT	27014	3-60018	153
A1IC23	SN7400N	INTEGRATED CIRCUIT	01295	3-60000	154
A1IC24	SN7490N	INTEGRATED CIRCUIT	01395	3-60005	155
A1IC25	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	156
A1IC26	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	157
A1IC27	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	158
A1IC28	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	159
A1IC29	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	160
A1IC30	SN7402N	INTEGRATED CIRCUIT	27014	3-60001	161
A1IC31	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	162
A1IC32	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	163
A1IC33	SN7490N	INTEGRATED CIRCUIT	01295	3-60005	164
A1IC34	NE529A	INTEGRATED CIRCUIT	18324	3-60042	165
A1IC35	CD4046AE	INTEGRATED CIRCUIT	86684	3-60043	166
A1IC36	LM301AN	INTEGRATED CIRCUIT	27014	3-60029	167
A1IC37	NE555V	INTEGRATED CIRCUIT	18324	3-60026	168
A1IC38	LM318H	INTEGRATED CIRCUIT	27014	3-60033	169
A1IC39	LM301AN	INTEGRATED CIRCUIT	27014	3-60029	170
A1IC40	MC1709P1	INTEGRATED CIRCUIT	27014	3-60041	171
A1IC41	MC1709P1	INTEGRATED CIRCUIT	27014	3-60041	172
A1IC42	CIC 230-4 (YEL)	INTEGRATED CIRCUIT	16067	3-60037	173
A1IC43	LM301AN	INTEGRATED CIRCUIT	27014	3-60029	174
A1IC44	LM301AN	INTEGRATED CIRCUIT	27014	3-60029	175
A1IC45	MC1709P1	INTEGRATED CIRCUIT	27014	3-60041	176
A1IC46	CIC 230-6 (BLU)	INTEGRATED CIRCUIT	16067	3-60039	177
A1IC47	LM301AN	INTEGRATED CIRCUIT	27014	3-60029	178
					179
					180

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P. C. BOARD ASSEMBLY | SHT 8 OF 15

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1Q15	CIC 365	TRANSISTOR, F.E.T.	16067	3-30245	217
A1Q16	U1898E	TRANSISTOR, F.E.T.	15818	3-30217	218
A1Q17	U1898E	TRANSISTOR, F.E.T.	15818	3-30217	219
A1Q18	U1898E	TRANSISTOR, F.E.T.	15818	3-30217	220
A1Q19	CIC 365	TRANSISTOR, F.E.T.	16067	3-30245	221
A1Q20	U1898E	TRANSISTOR, F.E.T.	15818	3-30217	222
A1Q21	CIC 365	TRANSISTOR, F.E.T.	16067	3-30245	223
A1Q22	2N5172	TRANSISTOR	56289	3-30219	224
A1Q23	2N5226	TRANSISTOR	81349	3-30239	225
A1Q24	2N3439	TRANSISTOR	81349	3-30244	226
					227
					228
					229
					230
					231
					232
A1R1	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	233
A1R2	RC07GF331J	RESISTOR 330Ω 5% 1/4W	81349	5-10041	234
A1R3	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	235
A1R4	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	236
A1R5	RC07GF331J	RESISTOR 330Ω 5% 1/4W	81349	5-10041	237
A1R6	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	238
A1R7	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	239
A1R8	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	240
A1R9	RC07GF151J	RESISTOR 150Ω 5% 1/4W	81349	5-10033	241
A1R10	RC07GF152J	RESISTOR 1.5K 5% 1/4W	81349	5-10057	242
A1R11	X201R501	POTETNIOMETER 500Ω	71450	5-70155	243
A1R12	RC07GF332J	RESISTOR 3.3K 5% 1/4W	81349	5-10064	244
A1R13	RC07GF471J	RESISTOR 470Ω 5% 1/4W	81349	5-10045	245
A1R14	NOT USED	RESISTOR			246
A1R15	RC07GF223J	RESISTOR 22K 5% 1/4W	81349	5-10084	247
A1R16	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	248
A1R17	RC07GF271J	RESISTOR 270Ω 5% 1/4W	81349	5-10039	249
A1R18	RC07GF271J	RESISTOR 270Ω 5% 1/4W	81349	5-10039	250
A1R19	RC20GF105J	RESISTOR 1M 5% 1/2W	81349	5-20092	251
A1R20	RC07GF126J	RESISTOR 12M 5% 1/4W	81349	5-10136	252

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P.C. BOARD ASSEMBLY | SHT 10 OF 15

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
					181
					182
					183
					184
					185
A1J1 THRU A1J5 NOT USED					186
A1J6	CS-3014-B-1	I.C. SOCKET 14 PIN	0000M	2-30056	187
A1J7	CS-3014-B-1	I.C. SOCKET 14 PIN	0000M	2-30056	188
A1J8	09-64-1081	CONNECTOR	27264	4-10198	189
					190
					191
					192
					193
A1K1	214-00008	RELAY 6V	31951	2-45127	194
					195
					196
A1L1	5250	CHOKE 100μH	76348	5-90053	197
A1L2	4662	CHOKE 1MH	76348	5-90050	198
A1L3	4662	CHOKE 1MH	76348	5-90050	199
					200
					201
					202
A1Q1	TIP 42 6A 160V PNP	TRANSISTOR	01295	3-30242	203
A1Q2	TIP 29	TRANSISTOR	01295	3-30241	204
A1Q3	2N5172	TRANSISTOR	56289	3-30219	205
A1Q4	PE 8050	TRANSISTOR	07263	3-30289	206
A1Q5	PE 8050	TRANSISTOR	07263	3-30289	207
A1Q6	CIC 365	TRANSISTOR, F.E.T.	16067	3-30245	208
A1Q7	2N5172	TRANSISTOR	56289	3-30219	209
A1Q8	2N5172	TRANSISTOR	56289	3-30219	210
A1Q9	CIC 365	TRANSISTOR, F.E.T.	16067	3-30245	211
A1Q10	2N5226	TRANSISTOR	81349	3-30239	212
A1Q11	2N5226	TRANSISTOR	81349	3-30239	213
A1Q12	CIC 365	TRANSISTOR, F.E.T.	16067	3-30245	214
A1Q13	CIC 365	TRANSISTOR, F.E.T.	16067	3-30245	215
A1Q14	CIC 365	TRANSISTOR, F.E.T.	16067	3-30245	216

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P.C. BOARD ASSEMBLY | SHT 9 OF 15

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R57	X201R251	POTENTIOMETER 250Ω	71450	5-70154	289
A1R58	PME55-30.41K-.1% 25PPM	RESISTOR 30.41K .1%	03888	5-80327	290
A1R59	CIC 512	RESISTOR 8.9976M	16067	5-60614	291
A1R60	PME60-100Ω-.1% 25PPM	RESISTOR 100Ω .1% 1/4W	03888	5-80383	292
A1R61	CIC 511-3	RESISTOR 10Ω .1% 2 1/2W	16067	5-80276	293
A1R62	RN60C2942F	RESISTOR 29.4K 1%	81349	5-60609	294
A1R63	PME55-137.4Ω .1% 25PPM	RESISTOR 137.4Ω .1%	03888	5-80325	295
A1R64	91A-10K	POTENTIOMETER 10K	73138	5-70203	296
A1R65	91A-10K	POTENTIOMETER 10K	73138	5-70203	297
A1R66	CIC 511-2	RESISTOR 1Ω .1% 2 1/2W	16067	5-80275	298
A1R67	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	299
A1R68	RN60C2942F	RESISTOR 29.4K 1%	81349	5-60609	300
A1R69	RC07GF106J	RESISTOR 10M 5% 1/4W	81349	5-10135	301
A1R70	CIC 511-1	RESISTOR .1Ω .1% 2 1/2W	16067	5-80274	302
A1R71	RC07GF515J	RESISTOR 5.1M 5% 1/4W	81349	5-10150	303
A1R72	91A-50Ω	POTENTIOMETER 50Ω	71450	5-70201	304
A1R73	PME55-2.637K-.1% 25PPM	RESISTOR 2.637K .1%	03888	5-80328	305
A1R74	CIC 512	RESISTOR 897.25K	16067	5-60614	306
A1R75	3299W-1-103	POTENTIOMETER 10K	80294	5-70208	307
A1R76	PME55-137.4Ω-.1% 25PPM	RESISTOR 137.4Ω .1%	03888	5-80325	308
A1R77	91A-1K	POTENTIOMETER 1K	73138	5-70204	309
A1R78	91A-1K	POTENTIOMETER 1K	73138	5-70204	310
A1R79	T.B.D.	RESISTOR T.B.D.			311
A1R80	CIC 512	RESISTOR 89.725K	16067	5-60614	312
A1R81	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	313
A1R82	RC32GF105J	RESISTOR 1M 5% 1W	81349	5-30007	314
A1R83	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	315
A1R84	91A-100Ω	POTENTIOMETER 100Ω	73138	5-70205	316
A1R85	91A-100Ω	POTENTIOMETER 100Ω	73138	5-70205	317
A1R86	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	318
A1R87	CIC 512	RESISTOR 9.975K	16067	5-60614	319
A1R88	PME55-44.98K-.1% 25PPM	RESISTOR 44.98K .1%	03888	5-80384	320
A1R89	X201R101	POTENTIOMETER 100Ω	71450	5-70153	321
A1R90	PME55-5K-.1% 15PPM	RESISTOR 5K .1%	03888	5-80385	322
A1R91	ET34X503	POTENTIOMETER 50K	30982	5-70133	323
A1R92	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	324

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P.C. BOARD ASSEMBLY | SHT 12 OF 15

SAN DIEGO, CALIFORNIA | 16067 | PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R21	RC07GF113J	RESISTOR 11K 5% 1/4W	81349	5-10077	253
A1R22	SEE UNIT ASSEMBLY 8545-400				254
A1R23	RC07GF223J	RESISTOR 22K 5% 1/4W	81349	5-10084	255
A1R24	RC07GF223J	RESISTOR 22K 5% 1/4W	81349	5-10084	256
A1R25	RC07GF512J	RESISTOR 5.1K 5% 1/4W	81349	5-10069	257
A1R26	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	258
A1R27	RC07GF302J	RESISTOR 3K 5% 1/4W	81349	5-10063	259
A1R28	RC07GF123J	RESISTOR 12K 5% 1/4W	81349	5-10078	260
A1R29	RC07GF512J	RESISTOR 5.1K 5% 1/4W	81349	5-10069	261
A1R30	RC07GF512J	RESISTOR 5.1K 5% 1/4W	81349	5-10069	262
A1R31	RC07GF223J	RESISTOR 22K 5% 1/4W	81349	5-10084	263
A1R32	RC07GF564J	RESISTOR 560K 5% 1/4W	81349	5-10117	264
A1R33	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	265
A1R34	RC07GF512J	RESISTOR 5.1K 5% 1/4W	81349	5-10069	266
A1R35	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	267
A1R36	RC07GF181J	RESISTOR 180Ω 5% 1/4W	81349	5-10035	268
A1R37	RC07GF202J	RESISTOR 2K 5% 1/4W	81349	5-10059	269
A1R38	RC07GF102J	RESISTOR 1K 5% 1/4W	81349	5-10053	270
A1R39	RC07GF183J	RESISTOR 18K 5% 1/4W	81349	5-10082	271
A1R40	RC07GF101J	RESISTOR 100Ω 5% 1/4W	81349	5-10029	272
A1R41	RC07GF223J	RESISTOR 22K 5% 1/4W	81349	5-10084	273
A1R42	PME75-1M-.1%-25PPM	RESISTOR 1M .1%	03888	5-80305	274
A1R43	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	275
A1R44	NOT USED	RESISTOR			276
A1R45	PME55-274.9K-.1%-25PPM	RESISTOR 274.9K .1%	03888	5-80326	277
A1R46	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	278
A1R47	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	279
A1R48	X201R252B	POTENTIOMETER 2.5K	71450	5-70177	280
A1R49	PME55-562Ω-.1% 25PPM	RESISTOR 562Ω .1%	03888	5-80323	281
A1R50	RN60C1502F	RESISTOR 15K 1%	81349	5-60454	282
A1R51	RN60C1502F	RESISTOR 15K 1%	81349	5-60454	283
A1R52	PME55-562Ω-.1% 25PPM	RESISTOR 562Ω .1%	03888	5-80323	284
A1R53	PME60-1K-.1% 25PPM	RESISTOR 1K .1% 1/4W	03888	5-80329	285
A1R54	RN60C1502F	RESISTOR 15K 1%	81349	5-60454	286
A1R55	RN60C1502F	RESISTOR 15K 1%	81349	5-60454	287
A1R56	91A-10Ω	POTENTIOMETER 10Ω	73138	5-70202	288

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P.C. BOARD ASSEMBLY | SHT 11 OF 15

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R129	3299W-1-503	POTENTIOMETER 50K	80294	5-70244	361
A1R130	PME60-10K-.1%-15PPM	RESISTOR 10K .1%	03888	5-80303	362
A1R131	RC07GF223J	RESISTOR 22K 5% 1/4W	81349	5-10084	363
A1R132	RN60D2002F	RESISTOR 20K 1%	81349	5-60098	364
A1R133	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	365
A1R134	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	366
A1R135	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	367
A1R136	RC07GF221J	RESISTOR 220Ω 5% 1/4W	81349	5-10037	368
A1R137	X201R101	POTENTIOMETER 100Ω	71450	5-70153	369
A1R138	RC07GF512J	RESISTOR 5.1K 5% 1/4W	81349	5-10069	370
A1R139	91A-20Ω	POTENTIOMETER 20Ω	73138	5-70206	371
A1R140	RC07GF202J	RESISTOR 2K 5% 1/4W	81349	5-10059	372
A1R141	PME60-10K-.1%-15PPM	RESISTOR 10K .1%	03888	5-80303	373
A1R142	RC07GF512J	RESISTOR 5.1K 5% 1/4W	81349	5-10069	374
A1R143	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	375
A1R144	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	376
A1R145	RC07GF474J	RESISTOR 470K 5% 1/4W	81349	5-10115	377
A1R146	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	378
A1R147	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	379
A1R148	PME60-50K-.1%-15PPM	RESISTOR 50K .1%	03888	5-80298	380
A1R149	NOT USED				381
A1R150	NOT USED				382
A1R151	RC07GF100J	RESISTOR 10Ω 5% 1/4W	81349	5-10005	383
A1R152		NOT USED			384
A1R153	RC07GF330J	RESISTOR 33Ω 5% 1/4W	81349	5-10017	385
A1R154	RC07GF100J	RESISTOR 10Ω 5% 1/4W	81349	5-10005	386
A1R155	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	387
A1R156	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	388
A1R157	RC07GF514J	RESISTOR 510K 5% 1/4W	81349	5-10116	389
					390
					391
					392
					393
					394
					395
					396

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P.C. BOARD ASSEMBLY | SHT 14 OF 15

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R93	RC07GF154J	RESISTOR 150K 5% 1/4W	81349	5-10104	325
A1R94	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	326
A1R95	RC07GF100J	RESISTOR 10Ω 5% 1/4W	81349	5-10005	327
A1R96	RC07GF152J	RESISTOR 1.5K 5% 1/4W	81349	5-10057	328
A1R97	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	329
A1R98	RN60D2002F	RESISTOR 20K 1%	81349	5-60098	330
A1R99	X201R101	POTENTIOMETER 100Ω	71450	5-70153	331
A1R100	RC07GF332J	RESISTOR 3.3K 5% 1/4W	81349	5-10064	332
A1R101	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	333
A1R102	RC07GF112J	RESISTOR 1.1K 5% 1/4W	81349	5-10054	334
A1R103	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	335
A1R104	PME60-45K-.1%-15PPM	RESISTOR 45K .1%	03888	5-80386	336
A1R105	91A-50Ω	POTENTIOMETER 50Ω	73138	5-70201	337
A1R106	PME55-5K-.1%-15PPM	RESISTOR 5K .1%	03888	5-80385	338
A1R107	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	339
A1R108	91A-1K	POTENTIOMETER 1K	73138	5-70204	340
A1R109	PME60-249.5K-.1%-15PPM	RESISTOR 249.5K .1%	03888	5-80387	341
A1R110	RC07GF473J	RESISTOR 47K 5% 1/4W	81349	5-10092	342
A1R111	RC07GF330J	RESISTOR 33Ω 5% 1/4W	81349	5-10017	343
A1R112	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	344
A1R113	RC07GF332J	RESISTOR 3.3K 5% 1/4W	81349	5-10064	345
A1R114	T.B.D.	RESISTOR T.B.D. 1%	16067		346
A1R115	PME60-10K-1%-15PPM	RESISTOR 10K 1%	03888	5-60620	347
A1R116	RC07GF474J	RESISTOR 470K 5% 1/4W	81349	5-10115	348
A1R117	PME60-250K-.1%-15PPM	RESISTOR 250K .1%	03888	5-80304	349
A1R118	RC07GF683J	RESISTOR 68K 5% 1/4W	81349	5-10096	350
A1R119	CIC-709-1 (WHT)	RESISTOR REF. KIT	16067	3-10225	351
A1R120	91A-100Ω	POTENTIOMETER 100Ω	73138	5-70205	352
A1R121	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	353
A1R122	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	354
A1R123	PME60-5.11K-1%-15PPM	RESISTOR 5.11K 1%	03888	5-80388	355
A1R124	RC07GF104J	RESISTOR 100K 5% 1/4W	81349	5-10100	356
A1R125	ET34X101	POTENTIOMETER 100Ω	30982	5-70184	357
A1R126	RC07GF105J	RESISTOR 1M 5% 1/4W	81349	5-10123	358
A1R127	RC07GF471J	RESISTOR 470Ω 5% 1/4W	81349	5-10045	359
A1R128	RC07GF154J	RESISTOR 150K 5% 1/4W	81349	5-10104	360

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P.C. BOARD ASSEMBLY | SHT 13 OF 15

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A2	8545-701-1	P.C. BOARD, DISPLAY	16067		1
	-7	P.C. BOARD, MECH.	16067	1-60192	2
					3
					4
					5
					6
A2DS1	SLA2	DISPLAY, POL.	0000S	2-30061	7
A2DS2	SLA1	DISPLAY, NUMERAL	0000S	2-30060	8
A2DS3	SLA1	DISPLAY, NUMERAL	0000S	2-30060	9
A2DS4	SLA1	DISPLAY, NUMERAL	0000S	2-30060	10
A2DS5	SLA1	DISPLAY, NUMERAL	0000S	2-30060	11
A2DS6	SLA1	DISPLAY, NUMERAL	0000S	2-30060	12
					13
					14
					15
					16
A2IC1	916C331X5SR	INTEGRATED CIRCUIT	56289	3-60034	17
A2IC2	916C331X5SR	INTEGRATED CIRCUIT	56289	3-60034	18
A2IC3	916C331X5SR	INTEGRATED CIRCUIT	56289	3-60034	19
A2IC4	916C331X5SR	INTEGRATED CIRCUIT	56289	3-60034	20
A2IC5	916C331X5SR	INTEGRATED CIRCUIT	56289	3-60034	21
A2IC6	SN7447AN	INTEGRATED CIRCUIT	01295	3-60015	22
A2IC7	SN7447AN	INTEGRATED CIRCUIT	01295	3-60015	23
A2IC8	SN7447AN	INTEGRATED CIRCUIT	01295	3-60015	24
A2IC9	SN7447AN	INTEGRATED CIRCUIT	01295	3-60015	25
A2IC10	SN7447AN	INTEGRATED CIRCUIT	01295	3-60015	26
					27
					28
					29
A2CR1	SI2	DIODE	14099	3-10079	30
					31
					32
					33
					34
					35
					36

MODEL DMC 45 | CALICO P/N 8545-701 | ASSY R.D. A2

TITLE P.C. BOARD ASSEMBLY - DISPLAY | SHT OF 4

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1S1	C8545-011	PUSHBUTTON SWITCH	16067	2-40445	397
A1S2	C8545-012	PUSHBUTTON SWITCH	16067	2-40446	398
					399
					400
					401
A1T1	A8545-010	TRANSFORMER, POWER	16067	7-10247	402
A1T2	A8545-014	TRANSFORMER, INVERTER	16067	7-10248	403
					404
					405
					406
A1Y1	CR-18A/U	CRYSTAL 1 MHz	13454	3-30135	407
	RCT05075-7A	TRANSIPAD	19080	2-40296	408
	RST-2-SM-1160SL	TERMINAL	98291	2-50228	409
	C8545-209-1	SHIELD	16067	1-10407	410
	6032D	HEATSINK	13103	2-10483	411
	102068	FUSE CLIP	75915	2-70020	412
	RG-174/U	WIRE, 1 COND. SHIELDED	81349		413
	N4-40 x 9/16 LG	SCREW, NYLON RND. HD.	95987	2-10141	414
	N4-40-X	NUT, NYLON - HEX	95987	2-10136	415
	2829-115-3	MOUSE TAIL	98159	2-10151	416
	J-76115-00	DOGBONE SPACER	71590		417
	4-40 x 1/4 LG	SCREW, PN. HD.			418
	4-40 x 5/16 LG	SCREW, PN. HD.			419
					420
	8-32 x 5/16 LG	SCREW, PN. HD.			421
	1299B-1	TERMINAL	88245	2-50146	422
	1591B	CHASSIS FASTENER	88245	2-10416	423
	#4	WASHER INT. STR.			424
	#8	WASHER INT. STR.			425
					426
					427
	#4-40	NUT, HEX			428
	#8-32	NUT, HEX			429
	P255-1/4 WIDE	MYLAR TAPE, ADHESIVE	99742		430
	P255-3/8 WIDE	MYLAR TAPE, ADHESIVE	99742		431
					432

MODEL DMC 45 | CALICO P/N 8545-700 | ASSY R.D. A1

TITLE MAIN P.C. BOARD ASSEMBLY | SHT 15 OF 15

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	8545-402-1	PRINT OUTPUT	16067		1
	SEE DWG. D8545-400 FOR PART PLACEMENT INFO.				2
					3
					4
					5
	DELETE: FROM STANDARD DMC 45				6
					7
	D8545-208-8	REAR PANEL	16067	1-10406	8
					9
					10
	ADD:				11
					12
J5	57-40240	RECEPTACLE 24 PIN	02660	4-10023	13
					14
					15
					16
P5	57-30240	PLUG 24 PIN	02660	4-10019	17
P6	5131-012	PLUG/RIB. CABLE 14 PIN	08261	4-10200	18
P7	5131-012	PLUG/RIB. CABLE 14 PIN	08261	4-10200	19
					20
	D8545-208-7	REAR PANEL	16067	1-10405	21
					22
	2-56 x 1/2 LG.	SCREW PN. HD			23
	#2	WASHER, FLAT			24
	#2	WASHER, INT. STR.			25
	2-56	NUT, HEX			26
					27
					28
					29
					30
					31
					32
					33
					34
					35
					36

MODEL DMC 45 OPTION "02" | CALICO P/N 8545-402 | ASSY R.D.

TITLE PRINT OUTPUT OPTION PARTS LIST | SHT 2 OF 2

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	8545-401-1	BATTERY PACK (ONE BAT.)	16067	OPTION - 01	1
	8545-401-2	BATTERY PACK (TWO BAT.)	16067	OPTION-01A	2
	SEE DWG D8545-400 FOR PART PLACEMENT INFO.				3
					4
					5
	DELETE: FROM STD. UNIT				6
	D8545-207-9	COVER TOP	16067	1-10404	7
					8
					9
	ADD:				10
					11
A3	C8545-702-1	P.C. BOARD ASSY BAT. CHAR.	16067		12
					13
B1	EP675A	BATTERY 6V, 7.5A	0000T	2-50204	14
B2	EP675A	BATTERY 6V, 7.5A	0000T	2-50204	15
					16
					17
					18
					19
	B8545-211-7	SHIM STRIP	16067	1-10420	20
	D8545-203-7	HOUSING, BATTERY	16067	2-10477	21
	D8545-207-7	COVER, TOP	16067	1-10402	22
	8545-103	DECAL *	16067	2-10485	23
		* INSTALL ON REAR PANEL			24
		BY "S3" SWITCH			25
					26
	6-32	NUT, HEX			27
	#6	WASHER, INT. STR.			28
					29
					30
					31
					32
					33
					34
					35
					36

MODEL DMC 45 OPTION "01" | CALICO P/N 8545-401 | ASSY R.D.

TITLE BATTERY PACK OPTION PARTS LIST | SHT 2 OF 2

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3	8545-702-1	P.C. BOARD ASSY	16067		1
	-7	P.C. BOARD MECH.	16067	1-60193	2
					3
					4
					5
A3CR1	1N5235B	DIODE, ZENER	04713	3-10196	6
A3CR2	1N914	DIODE	07910	3-10118	7
A3CR3	1N914	DIODE	07910	3-10118	8
A3CR4	1N914	DIODE	07910	3-10118	9
A3CR5	1N914	DIODE	07910	3-10118	10
P1-P7	NOT USED				11
A3P8	09-52-3081	CONNECTOR	27264	4-10197	12
					13
A3Q1	2N3055	TRANSISTOR	81349	3-30086	14
A3Q2	2N5226	TRANSISTOR	81349	3-30239	15
A3Q3	2N5172	TRANSISTOR	56289	3-30219	16
					17
	B-500-WM-PLS	WIRE MARKERS (+)	53209		18
	B-500-WM-MIN	WIRE MARKERS (-)	53209		19
					20
A3R1	RC07GF510J	RESISTOR 51Ω 5% 1/4W	81349	5-10022	21
A3R2	RC07GF510J	RESISTOR 51Ω 5% 1/4W	81349	5-10022	22
A3R3	X201R101	POTENTIOMETER 100Ω	71450	5-70153	23
A3R4	RS-2B-0R5-3W-3%	RESISTOR .5Ω 3W 3%	91637	5-50010	24
A3R5	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	25
A3R6	RC07GF472J	RESISTOR 4.7K 5% 1/4W	81349	5-10068	26
A3R7	RC07GF103J	RESISTOR 10K 5% 1/4W	81349	5-10076	27
					28
A3S3	7101MD7B	TOGGLE SWITCH SPDT	09353	2-40427	29
					30
	LAT03B4CB	HEATSINK	98978	2-10445	31
	RA18-205	TERMINAL, CLIP FEMALE	59730	2-50205	32
	RA18-188	TERMINAL, CLIP FEMALE	59730	2-50206	33
	6-32 X 3/8 LG.	SCREW PN. HD.			34
	#6	WASHER, INT. STR.			35
	6-32	NUT, HEX			36

MODEL DMC 45 | CALICO P/N 8545-702 | ASSY R.D. A3

TITLE P.C. BOARD ASSY, BATTERY CHARGER | SHT 4 OF 4

APPENDIX A

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbook H4-1 and its latest supplement. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbook.

0000A	ElectriCord	Westfield	PA
000AA	OK Machine and Tool Corp.	New York	NY
000AB	Falmat	Harbor City	CA
0000B	Tech. Prod. Sales	Sorrento Valley	CA
0000C	Jackson Bros.	Waddon, Surrey	GB
0000D	Chicago Std. Transformer Co.	Chicago	IL
0000E	Use Code #08289		
0000F	Colvern	Santa Monica	CA
0000G	Use Code #30983		
0000H	Mial of Italy c/o Q.C. Components	Los Angeles	CA
00001	Use Code #50522		
0000J	Use Code #34333		
0000K	Elma	Schweiz	GE
0000L	Use Code #32293		
0000M	Use Code #16950		
0000N	Use Code #15912		
0000P	Mesa Office Supply	San Diego	CA
0000R	American Handle	Philadelphia	PA
0000S	OPCDA	Edison	NJ
0000T	Use Code #31743		
0000U	Use Code #32293		
0000V	Falmat	Los Angeles	CA
0000W	Miltron Ross Co.	Southampton	PA
0000X	Use Code #52072		
0000Y	Use Code #29990		
0000Z	Timco	Los Angeles	CA
00141	Pic Design Corp.	E. Rockaway	NY
00194	Walsco Electronics Corporation	Los Angeles	CA
00544	Metal-Cal Div., Avery Prod. Corp.	Inglewood	CA
00656	Aerovox Corporation	New Bedford	MA
00779	AMP, Inc.	Harrisburg	PA
00853	Sangamo Electric Company	Pickens	SC
00866	Goe Eng. Co., Inc.	City of Industry	CA
01121	Allen-Bradley Company	Milwaukee	WI
01179	Ajax Magnethermic Corp.	NE Warren	OH
01255	Litton Industries, Inc.	Beverly Hills	CA
01281	T R W Semiconductors, Inc.	Lawndale	CA
*01295	Texas Instruments, Inc.	Dallas	TX
02111	Spectrol Electronics	City of Industry	CA
02114	Ferroxcube Corp.	Saugerties	NY
02335	Fairchild Controls Corp.	Hicksville, LI	NY
02660	Amphenol Corporation	Broadview	IL
02799	Use Code #72136		
03507	General Electric Company	Syracuse	NY
03508	General Electric Company	Syracuse	NY
03516	General Electric Company	Somersworth	NH
03797	Eldema Corporation	Compton	CA
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls	NJ
03911	Clairex Corporation	New York	NY
04009	Arrow-Hart and Hegeman Elec. Co.	Hartford	CT
04062	Use Code #72136		
04713	Motorola Semiconductor Prod., Inc.	Phoenix	AZ
04963	3-M	St. Paul	MN
05236	Jonathan Mfg. Co.	Fullerton	CA
05276	Pomona Electronics Co., Inc.	Pomona	CA
05347	Ultronixs	Grand Junction	CO
05397	Kemet, Union Carbide Corp.	Cleveland	OH
05820	Wakefield Engineering, Inc.	Wakefield	MA
06046	Dixson Meter	Grand Junction	CO
06184	Conelco Components	San Bernadino	CA
06223	Kooltronic Fan Company	Princeton	NJ
06229	Electrovert, Incorporated	Mt. Vernon	NY
06383	Panduit Corp.	Tinley Park	IL
06514	Stantron, Wyco Metal Products	N. Hollywood	CA
06540	Amathom Elect. Hardward	New Rochelle	NY
06682	Magnetic Shield Div.	Chicago	IL
06776	Robinson, Nugent, Inc.	New Albany	IN
06915	Richco Plastics, Co.	Chicago	IL
07088	Kelvin Electric Company	Van Nuys	CA
07115	Use Code #14674		
07256	Silicon Transistor Corp.	Garden City	NY
07263	Fairchild Camera and Instr. Corp.	Mt. View	CA
07387	Birtcher Corporation	Los Angeles	CA
07556	Unitrack Calabro Plastics	Upper Darby	PA
07633	Epoxy Prod. Co. Div. of Allied Prod. Corp.	New Haven	CT
07713	Sperry Rand Corporation	Norwalk	CT
07716	I R C Incorporated	Burrington	IA
07910	Continental Devices	Hawthorne	CA
08065	Accurate Rubber and Plastics Co.	San Diego	CA
08261	Spectra Strip	Garden Grove	CA
08289	Blinn-Delbert Co., Inc.	Pomona	CA
08594	Eimac Div. of Varian Associates	Salt Lake	UT
08718	Use Code #71468		
08730	Vemaline Products Co.	Franklin Lakes	NJ
09026	Babcock Electronics Corp.	Costa Mesa	CA
09145	Atohm, Technical Industries, Inc.	Burbank	CA
09353	C and K Components, Inc.	Newton	MA
11432	Diamond Metal Sales	Gardena	CA
11815	Cherry Rivet Div., Townsend Co.	Santa Ana	CA
12020	Ovenaire, Incorporated	Charlottesville	VA
12143	Bendix Corporation	Santa Ana	CA
12405	Hysol Corporation	El Monte	CA
12406	Elpac, Incorporated	Fullerton	CA
12463	Omtronics Mfg., Incorporated	Omaha	NE
12673	Wesco Electrical Co.	Greenfield	MA
12697	Clarostat Mfg. Co., Incorporated	Dover	NH
13103	Thermalloy Company	Dallas	TX
13454	Texas Crystals	River Grove	IL
13571	Electronic Research	Overland Park	KS
13919	Burr-Brown Research Corp.	Tucson	AS
14099	Semtech Corporation	Newbury Park	CA
14193	Cal-R Inc.	Santa Monica	CA
14604	Elmwood Sensors Inc.	Cranston	RI
14655	Cornell-Dubilier Elect. Corp.	Newark	NJ
14674	Corning Glass Works	Corning	NY
14726	Hollingsworth Co.	Phoenixville	PA
14752	Electro Cube, Incorporated	San Gabriel	CA
14907	Cramer Div. of Conrac	Old Saybrook	CT
15112	Electra Scientific Corporation	Fullerton	CA
15636	Elec-trol	Northridge	CA
15801	Fenwall Electronics	Framingham	MA
15818	Amelco Teledyne, Incorporated	Mt. View	CA
15909	Use Code #17870		
15912	Analey	Los Angeles	CA
16067	California Instruments Company	San Diego	CA
16758	Delco Radio Div., General Motors	Kokomo	IN
16795	Bristol Electronics Inc.	Bedford	MA
16902	Simpson Instruments, Inc.	Escondido	CA
16950	Precision Dynamics Corp.	Burbank	CA
16956	Dennison	Framingham	MS
17745	Angstrohm Precision, Inc.	Van Nuys	CA
17838	Mektron, California General, Inc.	Chula Vista	CA
17856	Siliconix	Santa Clara	CA
17870	Daven Div., Thomas A. Edison	Manchester	NH
18076	Umpco	City of Industry	CA
18121	Wilshire Foam Products, Inc.	Gardena	CA
18178	Vactec Inc.	Maryland Heights	MO
18324	Signatics	Sunnyvale	CA
18612	Vishay Instruments Inc.	Malvern	PA
18677	Scambe Mfg. Co.	Monterey Park	CA
18702	Ducommun Metals and Supply Co.	Los Angeles	CA
18722	R C A	Mountaintop	PA
19080	The Robinson Company	Hawthorne	CA
19781	Potter Company	Sun Valley	CA
20857	South Bay Cable Corp.	Gardena	CA
21270	Behr-Manning	Watervliet	NY
21604	Buckeye Stamping Company	Columbus	OH
22045	Jordan Elect.	Van Nuys	CA
22599	Elastic Stop Nut Corporation	Van Nuys	CA
23039	Deccofelt Products Company	Glendora	CA
23050	Product Components Corp.	Hastings-on-Hudson	NY
23095	Astec Electronics In.	Anaheim	CA
23783	British Radio Electric Ltd.	Washington	DC
23936	Pamotor, Incorporated	San Francisco	CA
24011	E C C	Burlington	MA
24655	General Radio	Concord	MA
24796	Parelco Inc.	Paramount	CA
24931	Speciality Connector Co., Inc.	Indianapolis	IN
25403	Amperex (Diodes)	Slaterville	RI
25684	Victoreen Instrument Co., Inc.	Oak Lawn	IL
25706	Daburn Electronics and Cable Corp.	New York	NY
*01963	Cherry Electronical Prod. Corp.	Waukegan	IL
26528	Lamcor Incorporated	Anaheim	CA
26533	Use Code #98376		
26806	American Zettler Inc.	Costa Mesa	CA
27014	National Semi-Conductor Corp.	Santa Clara	CA
27191	Cutler-Hammer, Inc.	Milwaukee	WI
27264	Molex	Downers Grove	IL
27556	iMB Electronic Products	Santa Fe Springs	CA
27683	Varo, Incorporated	St. Garland	TX
27832	Hughes Aircraft	Newport Beach	CA
28480	Hewlett-Packard Co	Palo Alto	CA
*28520	Heyman Mfg. Company (Heyco)	Kenilworth	NJ
30086	I-T-E Circuit Breaker Co.	Philadelphia	PA
30817	Instrument Specialties Co.	Little Falls	NJ
30897	Dorann Co.	Sylmar	CA
30983	Electra/Midland (Mepco/Electra)	San Diego	CA
31743	Elpower	Santa Ana	CA
31951	Tridge Inc.	Pittsburgh	PA
32293	Intersil	Cupertino	CA
34333	Silicon General	Westminister	CA
34649	Intel Corp.	Santa Clara	CA
35929	Constants	Quebec	CN
42190	Muter Company	Chicago	IL
44655	Ohmite Manufacturing Company	Skokie	IL
45722	Parker-Kalon	Clifton	NJ
46384	Penn. Eng. and Mfg. Corp.	Doylestown	PA
49956	Raytheon Co.	Lexington	MA
50522	Monsanto, Electronic Special Products	Cupertino	CA
50558	Electronic Concepts Inc.	Eatontown	NJ
51705	ICO/Rally	Palo Alto	CA
52072	Circuit Assembly Corp.	Costa Mesa	CA
53209	W. H. Brady Co.	Milwaukee	WI
56289	Sprague Electric Company	North Adams	MA
57771	Stimson	Bayport	NY
58474	Superior Electric Company	Bristol	CT
59730	Thomas and Betts Company	Elizabeth	NJ
60741	Triplett Electrical Instrument Co.	Bluffton	OH
63743	Ward Leonard Electric Co.	Mt. Vernon	NY
70318	Allmetal Screw Prod. Co.	Garden City	NY
70903	Belden Manufacturing Co.	Chicago	IL
71002	Birnbach Radio Company, Inc.	New York	NY
71218	Bud Radio	Willoughby	OH
71279	Cambridge Thermionic Corp.	Cambridge	MA
71400	Bussman Mfg. Div. McGraw-Edison Co.	St. Louis	MO
71450	CTS Corporation	Elkhart	IN
71468	ITT Cannon Electric Inc.	Los Angeles	CA
71590	Centralab Div. Globe-Union, Inc.	Milwaukee	WI
71707	Coto-Coil	Providence	RI
71744	Chicago Miniature Lampworks	Chicago	IL
71785	Cinch Manufacturing Company	Chicago	IL
72136	Elmenco (Electro Motive)	Willimantic	CT
72259	Nytronics, Incorporated	Pelham Manor	NY
72619	Dialight Corporation	Brooklyn	NY
72699	General Instruments	Newark	NJ
72982	Erie Technological Products, Inc.	Erie	PA
73138	Beckman Instruments, Inc.	Fullerton	CA
73445	Amperex (Capacitors)	Long Island	NY
73559	Carling Electric, Inc.	West Hartford	CT
73734	Federal Screw Products, Inc.	Chicago	IL
73899	J F D Electronics Company	Brooklyn	NY
73949	Guardian Electric Mfg. Co.	Chicago	IL
73957	Groov-Pin Corporation	Ridgefield	NJ
74193	Heinemann Electric Company	Trenton	NJ
74276	Signalite, Incorporated	Neptune	NJ
74542	Hoyt Electrical Instrument Works	Penacook	NH
74545	Harvey Hubbel, Inc.	Bridgeport	CT
74970	E. F. Johnson Company	Waseca	MN
75382	Kulka Electric Corporation	Mt. Vernon	NY
75915	Littlefuse, Incorporated	Des Plaines	IL
75987	Use Code #95987		
76055	Mallory Controls	Frankfort	IN
76348	Miller Products Company	New York	NY
76385	Minor Rubber Co.	Bloomfield	NJ
76493	J. W. Miller Company	Los Angeles	CA
76854	Oak Manufacturing Company	Crystal Lake	IL
77342	Potter and Brumfield Div., Amer. Machine and Foundry Company	E. Princeton	IN
77638	General Instruments	Brooklyn	NY
77969	Rubber Craft Corp. of California	Torrance	CA
78189	Shakeproof Div., Illinois Tool Works	Chicago	IL
78299	Struthers-Dunn, Incorporated	Pitman	NJ
78488	Stackpole Carbon Company	St. Marys	PA
78526	Stanwyck Winding Company, Inc.	Newburgh	NY
78553	Tinnerman Products, Inc.	Cleveland	OH
78947	Ucinite Company	Newtonville	MA
79130	Johns-Manville Products Corp.	Chicago	IL
79727	Continental-Wirt Electronics Corp.	Warminister	PA
79963	Zierick Mfg. Corporation	New Rochelle	NY
80031	Mepco/Electra	Morristown	NJ
80112	G. C. Electronics Company	Los Angeles	CA
80223	United Transformer Co.	New York	NY
80294	Bourns, Incorporated	Riverside	CA
80368	Sylvania Electric Products, Inc.	New York	NY
80583	Hammarlund Mfg. Co.	Red Bank	NJ
81073	Grayhill, Incorporated	La Grange	IL
81095	Triad Transformer Corp.	Venice	CA
81312	Winchester Electronics	Oakville	CT
81349	Military Spec., Standardization Division Directorate of Logistic Services DSA		
82104	Standard Grigsby	Aurora	IL
82389	Switchcraft, Incorporated	Chicago	IL
82877	Rotron Manufacturing Co., Inc.	Woodstock	NY
82893	Vector Electronics Inc.	Sylmar	CA
83058	Car Fastener Company	Cambridge	MA
83125	Nytronics Inc. Cap. Division	Darlington	SC
83324	Rosan, Incorporated	Newport Beach	CA
83330	Herman H. Smith, Inc.	Brooklyn	NY
83594	Burroughs Corporation	Plainfield	NJ
83701	Electronic Devices, Incorporated	Yonkers	NY
83781	Natl. Electronics	Geneva	IL
83827	Resistors Inc.	Chicago	IL
84171	Arco Electronics, Inc.	Great Neck	NY
86684	R C A	Harrison	NJ
86928	Seastrom Mfg. Co.	Glendale	CA
87034	Marco-Oak Industries	Anaheim	CA
88026	Use Code #27191		
88245	Useco Div., Litton Industries	Van Nuys	CA
89536	Fluke	Seattle	WA
90030	USM Corp.	Beverly	MA
90201	Mallory Capacitor Company	Indianapolis	IN
91459	Alcon Metal Prod. Inc.	Chicago	IL
91506	Augat	Attlebord	MA
91637	Dale Electronics, Inc.	Columbus	NE
91662	Elco Corporation	Willow Grove	PA
91812	Janco Corporation	Burbank	CA
91833	Keystone Electronics Corp.	New York	NY
91929	Micro Switch Div., Honeywell, Inc.	Freeport	IL
92194	Alpha Wire Corporation	Elizabeth	NJ
92219	Waldom Electronics, Inc.	Chicago	IL
93332	Sylvania Electric Products, Inc.	Woburn	MA
94222	Southco, Incorporated	Lester	PA
95146	Alco Electronics Products	Lawrence	MA
95303	R C A	Cincinnati	OH
95348	Gordos Corp.	Bloomfield	NJ
95416	Use Code #95146		
95987	Weckesser Company, Inc.	Chicago	IL
96682	Geniaco, Incorporated	Compton	CA
96733	San Fernando Electric Mfg. Co.	San Fernando	CA
97525	Electronic Engineering Co.	Santa Ana	CA
97918	Linemaster Switch Corp.	Woodstock	CT
97954	U.S. Components, Incorporated	Bronx	NY
98159	Rubber Teck, Incorporated	Gardena	CA
98278	Microdot, Incorporated (Lerco)	S. Pasadena	CA
98291	Sealecto Corp	Mamaroneck	NY
98376	Zero Mfg. Co. (West)	Burbank	CA
98978	IERC	Burbank	CA
99028	Globe	Gardena	CA
99378	Atlee Corp.	Woburn	MA
99392	STM Corporation	Oakland	CA
99515	Marshall Industries	Monrovia	CA
99517	Vacco Industries	El Monte	CA
99742	Permacel Div., Johnson and Johnson	New Brunswick	NJ
99743	I M C	Maywood	CA
99800	Delevan Electronics Corporation	Aurora	NY
*29990	American Technical Ceramics	Huntington Station	NY

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